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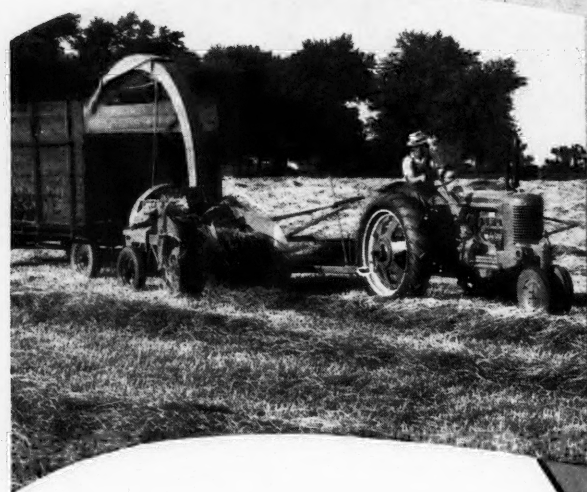

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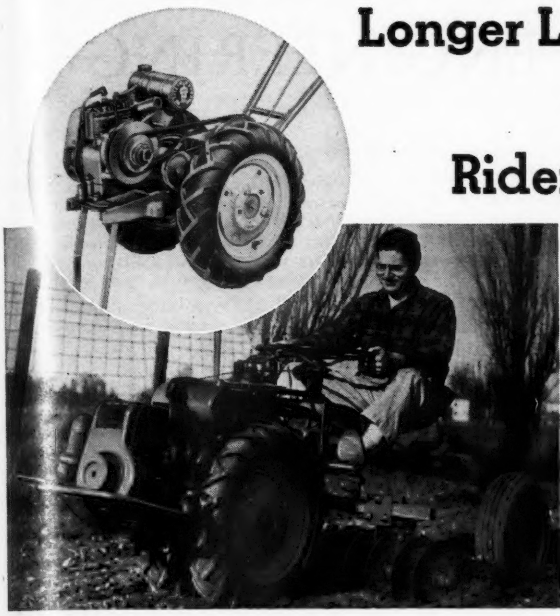

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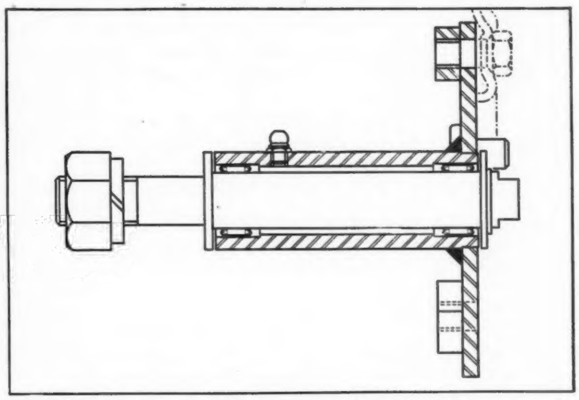

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AGRICULTURAL ENGINEERING

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CONTENTS FOR MAY, 1949

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EDITORIAL

Agricultural Education

WHAT is a suitable goal in training young men for farming? This is a question of legitimate interest to agricultural engineers. Some will have a direct part in that training. And the work of all will be influenced by the kind of training future farmers receive, and the resulting ways in which they live, think, and operate.

C. B. Gunlogson, president of Western Advertising Agency, and a member of the American Society of Agricultural Engineers since 1913, recently was invited to address a national conference on research related to future programs of agricultural education. In doing so, he took occasion to remind the conference that millions of dollars are being spent on agricultural education without any reasonably close agreement on objectives, or on effective means of educating toward any one objective.

What considerations must influence the determination of a suitable goal in agricultural education?

One which occurs to us is the fact that farm boys represent a wide range of aptitudes, capacities, interests, and preferences. One will have "the makings" to be most happy and useful in a life as a semi-skilled or skilled workman. Another will have the potential for development into an effective manager of thousands of acres or numerous individual farms. There will be hundreds of significant combinations of mental and manual aptitudes and interests.

Another consideration is that agriculture provides opportunity for effective use of an almost infinite variety of combinations of aptitudes, abilities, and interests. The diversified agriculture of one small community, or even one farm, will often require more diversified skills and knowledge than are commonly found in any one man.

These considerations remind us that the object is not to put all farm boys through a universal educational forming press and turn out one or even several standardized types of farmers, however ideal those types might be.

A more realistic goal would be to help individual farm boys discover and develop their particular aptitudes, capacities, and interests into their choice of the numerous general patterns which provide opportunity for a satisfying and useful life in agriculture.

Agricultural education will probably always be the victim of a tug of war between the advocates of general education and the proponents of vocational training. In this respect too, the logical goal may well be to balance the two types of training according to the aptitudes, interests, and prospects of the individuals being trained. How much broad cultural background will a boy need for the type of farm work for which he may be best suited? What mental and manual disciplines can be taught by stimulating his interest and by keeping educational pressure safely below the point at which he will simply rebel? Will he be happiest and most valuable to his community as an apple knocker who can quote Shakespeare but can't earn enough to decently support a family? Or as a farmer whose prosperity has outgrown his appreciation of cultural values? Or as some more balanced combination of capacity to earn and capacity to live?

It occurs to us that research related to future programs of agricultural education might well work toward increased recognition of the individual characteristics of the farm boys to be trained; and toward a more thorough analysis of the types and combinations of knowledge and abilities which contribute to a desirable farm community life.

What kinds of schools may be necessary to provide adequate educational opportunities for future farmers? Mr. Gunlogson suggests regional superhigh schools or junior colleges serving several counties, large and accessible enough to go beyond the training which vocational high schools can provide, for a lot more farm boys than can enjoy the opportunity to attend an agricultural college. There are some such schools. Their accomplishments seem worthy of careful study.

What about the cost of these intermediate schools? Could it begin to compare with the cost of undertraining, overtraining, or incorrectly training farm boys for the work in agriculture for which they are individually best fitted by nature? It might be considerably less than we waste annually in avoidable farm fires, in accidents, in insect, weed and plant and animal disease damage, and in destruction by rodents. The cost might also be more than covered by reducing the amount of substandard, low-efficiency farming, following something less than proven good practices, which is so common that it is scarcely recognized as one of the major wastes of agriculture.

The Engineering Snowball Is Rolling

A FORECAST of continuing and increasing opportunity for engineers has recently been announced by the Committee on Manpower of the American Society of Engineering Education. It estimates that there may be a slight excess of engineering graduates over engineering positions in the next year or two, but that over a longer period an increasing demand for engineers will absorb the increasing numbers being graduated.

This increasing demand is due to something more than a temporary boom in production, research, and governmental services, with pressure for expansion of existing engineering departments. It is pointed out that engineers are finding opportunities in new fields. Engineers are being drawn out of engineering departments into higher executive positions. Sales and administrative opportunities are calling for certain engineering qualifications. Broadened engineering curriculums are encouraging this wider dispersion of graduates.

Research is creating new industries, new products, and new production engineering departments. New industries are establishing research departments.

Pressures of increasing population and free enterprise are pushing for new and improved products and higher efficiencies.

Other parts of the world are bubbling with cultural and economic pressures for material progress, and looking to the United States for technical leadership.

The engineering snowball is rolling.

There is a growing appreciation of the wide range of inanimate and animate forms in which the materials and forces of nature respond to natural law. There is also an increasing appreciation of the engineer's capacity to deal quantitatively, accurately, and effectively with the physical forces and materials which are important factors in practically every human activity.

More people both within and outside of the engineering profession are realizing that agriculture involves materials and forces which are governed by natural law, and that many of these materials and forces can be managed most effectively by engineering techniques of thought and action.

It is something more than an accident of fate which makes the engineering outlook particularly favorable at present. The cumulative results of performance, professional integrity, technical soundness, a progressive outlook, and a spirit of service are paying off. Engineers have earned a measure of respect and responsibility. It is favorable to continuing opportunity. It can be maintained by remembering and upholding the principles on which it has been built.

The job of building up to this position has been completed. The job of maintaining it may be even more difficult. We must anticipate that there will be pressures from outside the engineering profession, and temptations within, to capitalize on the good name of engineering by applying it to projects which are impossible, impracticable, uneconomic, unethical, nontechnical, contrary to public interest and individual rights, and otherwise unsound and undesirable. So long as engineers continue to have a progressive spirit, all of these pitfalls cannot be avoided. There will be honest mistakes. But the worst of them can be avoided by maintaining a highly developed sense of professional integrity.

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AGRICULTURAL ENGINEERING

VOL. 30 MAY, 1949 No. 5

Results of Tests on Mechanical Loading Devices for Chopped Forages

By E. L. Barger, J. B. Liljedahl, W. W. Gunkel, and W. M. Carleton
MEMBER A.S.A.E. JUNIOR MEMBER A.S.A.E. JUNIOR MEMBER A.S.A.E. MEMBER A.S.A.E.

METHODS and equipment for harvesting, processing, and storing silage and hay was the subject of a project begun in the Iowa Agricultural Experiment Station in 1940. A preliminary study to determine the labor-duty and machine performance of the row binder and stationary silo filler method, was made in the fall of 1940[1]. It was found when considering operating time only, that silage could be stored with 2.07 man-hours per ton. Hauling and unloading represented 32.1 per cent of total labor. Following these preliminary trials a field harvester was substituted for the corn binder and a blower for the stationary cutter. Unloading was done manually with silage forks. The man-hours per ton were reduced to 1.17 and the hauling and unloading labor was then 89 per cent of the total. Unloading represented 56 per cent. This background of time study work focused attention on the importance of mechanizing the unloading operation. Two basic considerations were involved: first, to reduce the number of man-hours required; second, to change the character of the man-hour or make the task easier or less arduous.

Side Unloading. In 1941 attention was concentrated on the unloading operation with the following developments:

1 Trailer boxes were constructed with hinged sides to reduce the distance through which the chopped material would be moved and to simplify spotting the wagons at the blower.

2 A special conveyer hopper for the blower was constructed extending the full length of the trailers. This arrangement is shown in Fig. 1. The extended hopper was built with one vertical side to minimize bridging of the material. A kicker or retarding mechanism was developed for the blower to regulate feeding and to prevent slugging. This mechanism consisted of a binder packer assembly mounted above the throat opening of the blower. The packers stroked the material in the opposite direction of feed.

3 An automatic power winch was constructed using a 2-hp gasoline engine. This unit operated a drag fork made of one-half of a six-tined grapple fork. Suitable handles were attached. A scraper board was placed over the tines to clean the trailer box. The drag fork was operated back and forth by the power winch and controlled by one man. By using this system an operating performance of 0.45 man-hours per ton was accomplished with the field harvester and the mechanical unloading system described. The unloading labor was reduced to 20 per cent of the total.

While this system had advantages, it also had some shortcomings and disadvantages. It was found that, if the workmen were left to their choice, they would ignore the power fork and use hand forks. This was due partly to the fact that the power fork in order to be strong enough was heavy to handle by hand for a long period of time. With the side-opening wagons, especially where a ramp was placed for the outer wheel to pass over which inclined the wagon toward the conveyer, hand unloading was fairly easy. Questioning of the workmen indicated that they objected to climbing on top of the loose material and working from that position. When one considers that from 30 to 50 loads per day would be handled, it can be appreciated that this would be tiring and a reduction of the arduousness of the task had not been achieved. The extended conveyer and the dump hoppers to be discussed later were expensive, not durable or dependable, and were difficult to transport from one silo to another. However, spotting of wagons was simple and fast.

The longer conveyer hopper and feed regulator or kicker improved the capacity of the blower as much as 17.5 per cent.

Side Dumping. Before abandoning the side-unloading method a system of side dumping was attempted. This method (Fig. 2) used the same side-opening wagons. These were equipped with woven wire and canvas aprons placed crosswise of the trailer bed and attached to the upper edge of the drop side. The apron reached across the wagon and attached

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E. L. BARGER and J. B. LILJEDAHL are, respectively, research professor, and research assistant professor, and W. W. GUNKEL and W. M. CARLETON were formerly graduate research assistants, Iowa Agricultural Experiment Station.

[1] J. B. Davidson, C. K. Shedd and E. V. Collins. Labor duty in the harvesting of ensilage. Agricultural Engineering, vol. 24, no. 9, pp 293-294, September, 1943.

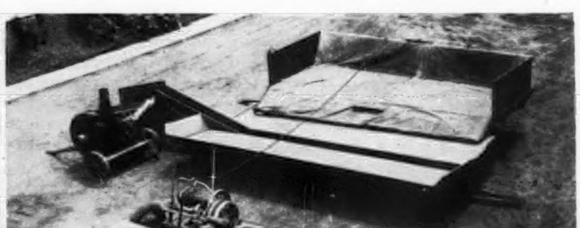

Fig. 1 (*Left*) Arrangement for side-unloading of wagons using an extended hopper and power fork • Fig. 2 (*Right*) Arrangement for side-dumping of wagons into extended hopper

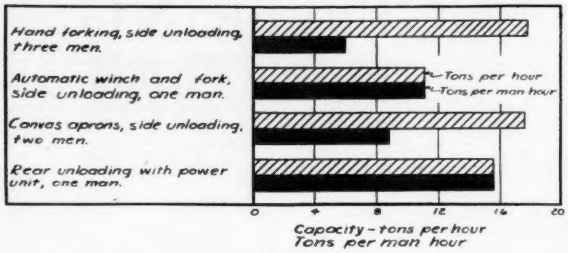

Fig. 3 A comparison of four systems of unloading silage

to an evener with a clevis in the center, and this was carried on brackets at the top edge of the opposite side of the wagon. A power winch was used to roll the load onto a receiving platform or hopper. It was necessary to divide the loads into two parts and pull them off separately. The loads weighed from two to four tons. The force to move the entire load was over 2,000 lb. This placed excessive stresses on the trailer and box. An effective method of dividing the loads was by the use of a "load splitter" consisting of a 2-ft width of woven wire. The wire had an anchor on one end next to the drop side and a clevis and evener on the opposite end. The operation required three pulls, the first removing the center section and splitting the load, which would normally take off from a fourth to a third of the load. A pull then on each canvas would roll the remainder of the load onto the platform. The force required was up to 1,000 lb. A drag trench with a chain conveyer the length of the platform fed the material into the regular blower hopper as illustrated. This system was used for the greater part of three years. Modifications were made each year. The system was tried with the vertical-side extended conveyer similar to that used with the power fork. This was not practical since room was needed to dump the entire load.

The following year the hopper was flared and widened. The third year the hopper was built lower and flatter. Various types of woven-wire aprons were discarded in favor of canvas. The second year of operation this unit handled over 2,000 tons of silage. The arduousness of the task of handling the silage was greatly reduced. The third year this system was compared with rear-unloading systems using both canvas aprons and sliding endgates. The comparison of the side-unloading operations with rear-end unloading systems is shown graphically in Fig. 3. Hand unloading with three men gave a capacity of 18 tons per hour, or 6 tons per man-hour. The power fork system had a capacity of 11 tons per hour and 11 tons per man-hour, since it was a one-man system. The side-dumping system had a capacity of 17.5 tons per hour and a labor performance of 8.75 tons per man-hour. The rear unloading operation gave a capacity of 15.6 tons per hour and 15.6 tons per man-hour, since it was also a one-man system.

The side-dumping system was not developed further because it was primarily a two-man system. Also a special unloading platform was required and this of necessity was large, cumbersome, and expensive. The power winch was a specialized piece of apparatus, relatively expensive and limited in use. At first it was assumed some advantage would result if it were possible to unload the trailer or truck rapidly and then send it back to the field without waiting for the blower to have elevated the entire load. It was possible to unload a three-ton load in approximately 3 min. The load would normally be elevated in 6 to 7 min. By the time the canvases were replaced, the side closed, and the wagon on its way, most of the load would be through the blower. In other words, the advantage of quick dumping did not show up too favorably in the use of this equipment. The chief advantages of this system were that spotting of trailers was easy and the uniform rate of feed made possible by the extended conveyer improved the performance of the blower. It was an ideal method of feeding material into a blower. A total of 3,000 tons of chopped forage was handled with this apparatus.

The side-dumping trailers and trucks showed merit in filling trench silos.

Rear Unloading. Tests in 1947 and 1948 were limited to rear-unloading methods. Two types of equipment were tested. They were the canvas apron with the roller at the rear of the trailer, and the cable and false endgate system using the same type of roller at the rear of the wagon. These are both basically controlled rate of unloading methods, i.e., a rate equal to the blower capacity. Also various shapes and sizes of wagons and various floor treatments were included in the tests.

Results of Tests of Rear-Unloading Equipment. The two types of unloading devices are compared in Fig. 4. The curves are force diagrams or indicator cards taken from the instrument used to measure the force and power requirements of the unloading devices. They are sample curves superimposed for comparison. It is evident that the false endgate and cable system requires a higher maximum force. With the cable and endgate system there is a delay in the discharge of the load while the load is being compressed. The maximum force occurs at the point at which the maximum compression occurs and the movement of the load is imminent. The force then decreases gradually until the load is discharged. The canvas unit requires a lesser maximum force as indicated. There is less compressing of the load. The discharge starts immediately with the starting with the roller. On the other hand, the average force with the canvas system is nearly as high as the sliding endgate system. The length of the chart in this case indicates the length of the wagon.

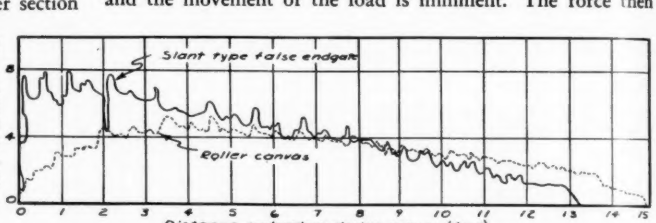

Fig. 4 A comparison of two indicator cards taken by instrument used to measure force and power requirements of unloading devices

Fig. 5 compares ten different combinations of unloading equipment and forage wagons. A statistical analysis of the data shows no significant difference in the unloading time or capacity with any of the combinations. This is to be expected since the capacity of the blower pretty largely determines rate of unloading. There was a significant difference in the torque requirements between the canvas and the endgate system, in favor of the canvas.

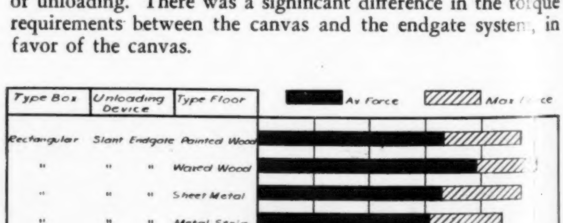

Fig. 5 Adjusted average and maximum forces required to unload silage with different wagon box shapes, floor treatments, and unloading devices

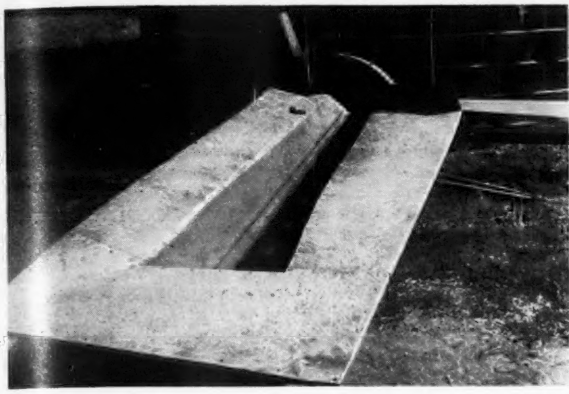

Fig. 6 (*Left*) Modification of a standard blower hopper to reduce spillage when using rear-end mechanical unloading • Fig. 7 (*Right*) Dual-purpose power unit for operating rear-end unloading devices and portable grain elevators

The first four bars in the chart give average force and maximum force to unload adjusted weights of corn silage from rectangular 7x14-ft wagons with four types of floor coverings as listed. A slanting-type false endgate was used in comparing the floor coverings. The metal strip floor consisted of metal strips on which the metal runners under the endgate could slide instead of sliding on the wooden floor. The sanded and waxed floor using the movable endgate and cables did not appear as favorable as had been expected. The painted wood floor was quite satisfactory.

A vertical endgate and a slanting endgate were compared in the wagon box with the metal floor strips. The difference between force required for the two types of endgate is very small and non-conclusive.

Canvas on a sheet metal floor was compared with canvas on a waxed wood floor in a series of tests, and, as indicated, the waxed floor was considerably better as regards force required.

A box was tapered with a difference of 2 ft between front and rear — being wider at the rear — and this is compared with the rectangular box with the waxed floor using canvas. The tapering of the box had an appreciable effect on reducing the average force and the maximum force. The reduction was 16 per cent. A deep, short box was constructed that was 7 ft wide, 8 ft long, and 6 ft high. A slanting-type endgate was used in this box with a waxed floor. The results of this test indicate no particular advantage with a high deep box as compared to the conventional rectangular 7 x14-ft lower box.

In no case were the performance differences noticeable or significant as far as field operation was concerned, with the equipment used.

Blower Hoppers for Mechanical Unloading. It was found early in the work that the receiving hoppers of most blowers were not well suited to rear-end mechanical unloading. Generally they were not low enough or flared wide enough to minimize spillage. Frequently a cleanup time equal to one-half of the unloading time would be required. Also spotting of trailers or trucks was critical, even requiring that the vehicle be backed until it touched the hopper. This is difficult and sometimes injurious to the blower. A hopper is needed that will allow a tolerance of several inches in spotting the trailer. A standard make of blower was modified as illustrated in Fig. 6. In this case a sheet metal apron or flange was built around the hopper. The hopper was made somewhat shallower, wider, and longer. The width of the flare was 44 in over all. The design used here permits the trailer to back and extend over the edge of the flare and stop anywhere within a distance of 8 or 10 in. It is not felt that sloping sides with angles equal to the flow angle of the material are necessary. The material will not flow on any reasonable slope anyway. On the other hand, if flares are provided, the silage will drop and before spilling will pile up and form its own flow angle. After the load is unloaded, one pass with a fork or hand will clear off the flares and reduce spillage on the ground to a minimum.

Power Units for Rear Unloading. To power the rear-unloading devices, a suitable drive unit providing low speed and high torque is essential. Several devices were used, tested, discarded, or altered. The hatchet-type speed reducer was satisfactory. It possessed simple speed change possibilities and seemed to have some advantage in the shock resulting in that type of drive. The jerking motion would tend to knock or shake off the material at the rear of the load without as much work by the operator, but this was not very important. The ratchet-type reducer did have a distinct disadvantage in that the mechanical advantage is not proportional to the speeds of the power unit and the final-drive roller. Fig. 7 shows the power-drive unit finally developed and used for two years. The amount of material unloaded with this unit has exceeded 4,000 tons. It has given very good performance. A requirement in the design of this unit was that it should be able to power a grain elevator as well as unload chopped forage. A 5 hp. engine was used and two points of take-off were provided. One take-off provides a speed suitable for mechanical unloading. The reductions are 18.3 to 1 and 915 to 1 at the two points of power take-off. The engine with power enough for elevator service permits wide range throttle adjustments when unloading forage. Speeds of from ½ rpm up are possible. Speeds between 2 and 3 rpm were most commonly used for unloading. The power unit has been used 340 hr per year and is one of the most used machines with the exception of the tractor.

Power requirements for mechanical unloading are not high. The maximum power requirements measured occurred with a load requiring 14,500 in-lb maximum torque, at 2 rpm. The calculated horsepower was 0.658 or less than ¾ hp.

A problem for consideration has to do with powering the unloading devices by hand. The studies show that force requirements are proportional to the load weight. The coefficient of friction, using average maximum forces, is 0.87. Using blower capacity of 1000 lb per min, which appears to be good and considering the mean maximum forces required for unloading the adjusted load weight of 5326 lb, the power input would be in the order of 0.3 hp. The average power input for the entire load using the mean of the average force requirements is very nearly 0.2 hp. These rates of doing work manually are possible but are definitely on the arduous side if 1/8 to 1/10 hp are considered as reasonable continuous outputs for a workman. Obviously a reduction in load size makes it possible to power the unit manually but the rate of unloading is quite likely to be at a rate less than the capacity of a good forage blower.

Economics of Soil Conservation

By E. L. Sauer

BEFORE adopting any new conservation practice or program, the farmer wants to know what will it cost and what are the benefits.

The farmer is the one who can make conservation work on his land. Most farmers are in business to make a living. That is why it is important for them to know what conservation is and how it affects their farms and their incomes.

In 1936-37, research studies in the economics of soil conservation were set up with the idea of getting practical information that would help farmers and those working with farmers. The studies were conducted cooperatively by the department of agricultural economics and the Agricultural Experiment Station of the University of Illinois and the research division of the Soil and Conservation Service, U. S. Department of Agriculture. To get practical results, the farm was used as the laboratory. Farms following conservation plans and practices were compared with neighboring, otherwise comparable farms not following conservation plans and practices.

Contouring Results in Crop Yield Increases. Contouring, contour strip cropping, grass waterways, and terracing are among the most popular and widely used mechanical conservation practices. To measure the effects of these practices, yields of crops grown on the contour, in contour stripes, or on terraced fields on the contour were compared with those of the same crops grown on the same farms up and down hill or in the usual field pattern. In so far as possible this comparison eliminated differences in management and in practices other than contouring. Yield results for a seven-year period are summarized in Table 1.

TABLE 1. Yield Increases for Crops Grown on the Contour Compared With Farming Up and Down the Slope on the Same Illinois Farms (Seven-Year Average, 1939 - 45)

Crop	No. of farms	Increase from contouring: Bushels per acre	Per cent
Corn	124	6.9	12
Soybeans	48	2.7	13
Oats	46	6.9	16
Wheat	40	3.4	17

Costs of Contour Farming. The effect of contour farming on total farm operating costs was studied on 270 Illinois accounting farms for the four years 1940 - 43. Farms on which all or most of the farming operations were on the contour were matched with comparable farms which followed a similar pattern of farming but on which few if any field operations were on the contour. This study indicates no significant difference in total expense for labor, power, and machinery between farms operating on the contour and those not on the contour (Table 2). The small difference in expenses favored contour farming.

TABLE 2. Man Labor Costs and Power and Machinery Costs Per Crop Acre on 135 Contour-Tilled Farms Compared With 135 Farms Not Contour Tilled (Four-Year Average, 1940 - 43)

Item	Contour tilled	Not contour tilled
Man labor cost	$11.20	$12.04
Power and machinery costs	7.46	7.82

Effects of a Complete Conservation Farm Plan on the Farm Business. Studies were also made in selected areas of Illinois to determine the effect of soil and water conservation programs on crop and livestock production and on farm incomes. These studies compared matched high and low-conservation farms. The farms had similar land-use capabilities and were similar in size but used different amounts of soil and water conservation practices. In other words, they were alike in physical characteristics but different in the degree to which they applied conservation practices.

Both the high and low-conservation farms were selected from the farms of Illinois account keepers and survey record cooperators, and may represent better-than-average management for their respective areas. Both groups may also have done a better job of conservation than the average farm in the area. The high-conservation farms, however, have invested more capital for land improvements, conservation practices, buildings, etc., in operating the farm business than have the low-conservation farms. They have also more nearly met their needs for minerals, such as limestone, phosphate, and potash, and have put into effect more water-disposal practices, including contouring, terracing, grass waterways, etc., and more pasture-improvement practices.

That the benefits from a conservation program increase from year to year is shown by 10 years of records in McLean County. The per acre net income on the 20 farms with present high-conservation scores was lower in 1936 than on the 20 physically comparable farms with present low scores. But in 1936 - 40 it was $2.36 higher, and in 1941 - 45, $4.17 higher (Fig. 1). For the 10-yr average, it was $3.46 higher, or $5,536 more net income for a 160-acre farm for the 10-yr period 1936 - 45.

Increased yields accounted for an important part of the difference in earnings between the high and low farms (Fig. 2). On the high-conservation farms corn yields were 3 bu per acre higher in 1936 - 40 and 6 bu higher in 1941 - 45. This increase in yield on the high farms is due largely to better land

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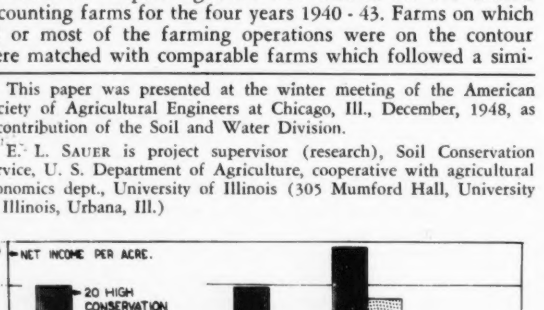


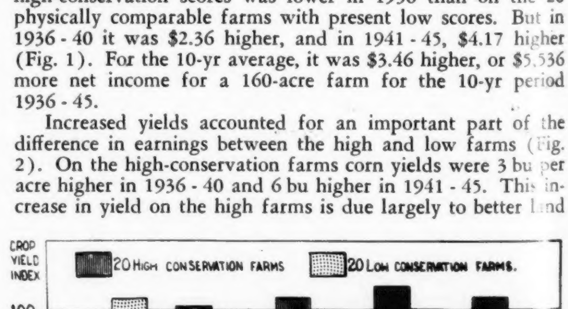


Fig. 1 (*Left*) Net income per acre, identical farms with high and low conservation scores, McLean County, 1936-45 • Fig. 2 (*Right*) Crop yield index for same group of farms as in Fig. 1

use, more limestone, phosphate, and mixed fertilizer, and wider use of such practices as contouring, strip cropping, terracing, grass waterways, and tile and open-ditch drainage. It should be noted that these differences between the farms are continuing to widen.

For the 10 years, conservation costs on these farms averaged 4 per cent of gross income compared with less than 3 per cent for the low farms. The average cost, about $2.00 an acre, was about 50 per cent above that for the low group.

In Madison - St. Clair Counties, from 1939 to 1947, conservation practices brought similar benefits. The high-conservation farms fed slightly more feed per acre and had higher average returns per $100 worth of feed fed. Corn yields were about 5 bu per acre higher. For the 9-yr period, net farm incomes averaged $5.60 per acre per year higher. There the annual costs for buildings and land improvements averaged $1.59 per acre higher on the high-conservation farms.

The high-conservation farms managed their entire farm business more successfully than the low farms, including the use of capital for conservation and for increased production. Soil fertility treatments and erosion control and pasture improvement practices produced more hay and pasture of higher feed value. The conservation farmers adjusted other parts of their business to make good use of the added hay and pasture. Their livestock returns were higher because they used the extra crops produced from the conservation plan.

In northwestern Illinois—Stephenson, JoDaviess, and Winnebago Counties—from 1940 to 1947, 35 high-conservation farms had an average net income of $6.65 more per acre, or 31 per cent more than 35 low-conservation farms.

Immediate Benefits from Conservation. Although long-time benefits from conservation farming are practically certain, the farmer is more interested in immediate returns. Often he is willing to use conservation practices only if he can see results more or less immediately. Such practices as contouring usually increase crop yield the first year because they hold the rainfall needed to produce high yields. Limestone, phosphate, and other fertilizers likewise have some effect on crops grown the year the fertilizers are applied. But the benefits from improved crop rotations generally do not show up until the grain crop harvested the year after legumes are plowed down.

During the three-year period, 1945 - 47, 18 farms in McLean County (on which conservation plans were started in 1945 or since) produced grain equal in dollars and cents to that produced on comparable farms not following conservation plans. In addition they had over twice as large an acreage of legume hay and pasture and were building up their land for crop production in subsequent years. They also had lower total labor, power and machinery operating costs because of a smaller acreage of cash crops. These results show that even in the cash grain area conservation plans will yield dividends on a short-run basis.

CAPITAL REQUIREMENTS FOR CONSERVATION FARMING

Capital expenditures for conservation and related improvements were analyzed on 100 farms located on slowly permeable soils in northeastern Illinois. For the years 1945 - 47 average annual capital expenditures were $3,210, or $12 an acre. Of the $12 an acre, $1.65 was spent for land improvements, 96 cents for buildings, $5.85 for livestock, and $3.54 for machinery. Larger livestock purchases caused owner-operated farms to spend more than tenant-operated farms.

The farmers in this area were asked what their farms needed in order to develop a good conservation program. Standard costs were used to reduce estimates of materials to dollars and cents. These costs averaged $6,600, or approximately $24 an acre. They included needed applications of limestone and phosphate, drainage, and conservation structures, as well as livestock, buildings, and machinery needed to use increased quantities of roughages. The estimates included as many non-land improvement items (livestock, buildings, machinery) as land improvement. Estimated conservation needs averaged somewhat more on the tenant-operated farms than on the owner-operated farms.

The conservation plans worked out by soil conservation technicians and farm advisers with these farmers were then analyzed to determine the costs of establishing conservation programs in this area. The land improvements alone amounted to $23 an acre. The plans showed the need for much larger applications of limestone, phosphate, potash, and mixed fertilizers than the farmers estimated. The requirements outlined in the plans are based on soil tests and agricultural experiment station recommendations for maintaining a high level of production. The results in this area indicate that farmers tend to apply too little limestone and other mineral fertilizers to maintain the good stands and yields of legumes basic to any program of soil improvement and conservation.

The farmers thought they needed more tiling and other structures than were recommended by soil conservation technicians and farm advisers. The plans emphasized grass waterways, sod flumes, terraces, and open ditches. If the $12 an acre estimated to be needed for buildings, livestock, and machinery to implement a conservation program were added to the $23 for land improvements, the total cost of a conservation program would approximate $35 an acre, or $8,400 for a 240-acre farm.

CONSERVATION COSTS VARY FROM FARM TO FARM

Farmers and landowners will question the outlay of $35 an acre for conservation unless they sincerely believe it will pay. For the three years, 1945 - 47, the annual income of 40 high-conservation farms in this area averaged $10.63 an acre more than that of 40 low-conservation farms. At the present high level of prices, the capital outlay for conservation could be repaid over a short period of years. Conservation costs vary, of course, from farm to farm and from area to area. All conservation expenditures do not need to be made at the same time or the same year. In all areas studied, however, conservation has proved to be a paying proposition over a period of years, although income may actually be reduced during the first year or so that a conservation system is adopted. Hence, unless the farmer has adequate capital resources to tide him over until he starts to reap benefits from a conservation program, he may find it difficult to start such a program except by spreading the improvements over a period of several years. Some farmers do not have enough money to start a conservation plan. On many owner-operated farms, the owner has to meet current payments on the land and does not have enough extra to make soil conservation improvements.

Present loan terms of lenders are not adapted to advancing credit for soil conservation improvements. To allow for variations in rates of response from different soils and weather hazards, it should be possible to amortize loans for conservation purposes according to increased earnings from conservation over a period of at least five years. A good plan for conservation loans might be (1) to prepare a budget to cover the whole conservation plan and (2) to secure a mortgage loan comitment on a budget basis so the farmer can borrow as conservation expenditures are made and pay off the loan over a period of years from increased earnings, with interest charges only for the period the money is used.

Farmers should try to use their available capital in the wisest possible way. They should so invest it as to get the highest farm income over a long-time period and still keep soil productivity at a satisfactory level. In the past most farms have underinvested in land improvements, and some may have overinvested in machinery and buildings. The result is partial depletion of fertility—sometimes even irreparable erosion—and lower incomes.

Returns from land improvements are not realized as quickly as those from many other investments. But the fact that their incomes may not increase during the first two or three years of the conservation program should not deter farmers from making such investments. After this period the increased returns will usually more than justify the cost and the period of waiting. While repaying conservation loans, farmers are increasing their net worth by improving soil productivity, hence the productive value of their farms.

Reduced Incomes and Capital Losses from Non-Conservation Farming. In a particular year the farm following a non-conservation type of farming may have the highest income. However, non-conservation farming removes plant food and

will bring about progressively lower crop yields. This places responsibility on owners of rented land to take the initiative in soil improvement. The larger acreage of hay and pasture and soil-building legumes on the high-conservation farms results in less net removal of nitrogen than in the low group, even though more grain and hay are produced. Most of the high-conservation farms spend enough for limestone, phosphate, and other fertilizers to replace the elements removed by crops and to improve yields. The low group spends hardly half enough to balance crop removals and maintain fertility. Studies from experimental plots show that from 2 to 20 times as much plant food is removed by erosion as by crops. On rolling land erosion will also exact a toll. In figuring conservation costs on the high-conservation farms, it is only fair also to consider the costs of loss of plant food and soil on the nonconservation farms.

LIVESTOCK AND CONSERVATION

More livestock may be needed on many farms to use the increased legumes and grasses resulting from a conservation program. Often farm operators, particularly cash-grain farmers, are reluctant to increase legume and grass acreages beyond a certain extent because they think a reduction in grain acreage means reduced income. On farms where grain acreages must be materially reduced in order to use the land according to its capabilities, increases in crop yields may not offset reductions in acreages. But in most cases the increased returns from livestock bring higher net incomes. In addition, this system of farming helps to conserve soil and water and improve fertility. Modest improvements for livestock production may be a pertinent part of a conservation program.

In each area studied, the high-conservation farms had higher returns per $100 worth of feed fed and produced more pounds of milk and meat per acre than the low-conservation farms. In part, if not entirely, these higher returns and production were due to the larger quantities of better-quality roughage produced. Higher crop yields reflect the effect of added minerals, legumes and grasses, and more manure. More livestock generally follows a greater production of hay and pasture, and most farmers tend to do more with livestock when it becomes an important part of the farm business.

TENURE AND CONSERVATION

In our studies the part-owner-operated farms had the highest proportion of tillable land in corn and soybeans and the owner farms the lowest. But the owner farms had more tillable land in hay and pasture. The rented part of part-owner-operated farms is usually farmed harder than owner or tenant-operated land. This point is too often overlooked by owners who prefer to own unimproved land. Annual per acre expenditures for conservation, land improvements, and buildings were highest on owner-operated farms and lowest on tenant-operated farms. The largest total outlay for conservation was, however, on debt-free, owner-operated farms and on tenant-operated farms where the landlord had adequate capital and both he and the tenant were sold on the program. The amount of livestock and livestock production per farm was considerably higher on the owner-operated farms than on the other two groups.

Tenure problems keep some landowners from adopting conservation practices. In areas with a high proportion of tenancy, how to divide increased costs and increased returns between landowner and tenant is a real problem. Another problem is how to use the increased quantities of roughages produced under a conservation plan. If livestock numbers are to be increased and grain acreages reduced on rented farms, livestock-share leases may have to replace some crop-share-cash leases. Both landlords and tenants might benefit from using a livestock-share lease. Certainly conservation practices are more readily adopted under such a lease, and landlords are more willing to make needed improvements. Livestock-share leases would give operators sufficient flexibility of operation to permit sound land-use programs. Longer term leases would also be desirable. Leases should include specific provision for compensating tenants who move for the remaining value of improvements they have made. Such a provision should make tenants more willing to invest in long-time improvements.

SUMMARY

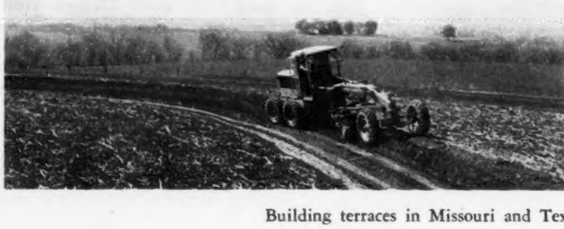
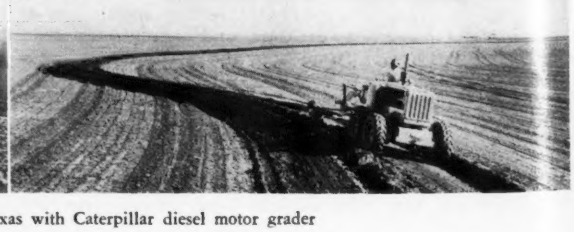
Our economic studies of conservation to date have not given us all of the answers to the problem. But they have pointed out significant relationships and have helped us to lay the groundwork for further studies in the field. From the standpoint of helping the individual farmer and the agricultural worker, we believe they point to the following significant facts:

The farms that scored highest in conservation practices followed a complete plan, including (1) testing and treating the soil, (2) using the land according to its capabilities, (3) using rotations with ample acreages of deep-rooted legumes, and (4) using proper water-disposal practices, such as grass waterways, contouring, strip cropping, terracing, and tile and open-ditch drainage where needed. These farms also tend to utilize forage crops through livestock.

Conservation plans do not necessarily increase earnings immediately, because considerable effort and money must usually be expended before positive results are achieved. The long-time benefits of conservation, however, are certain. Over a long-term period, conservation farms that have spent more money for soil and related improvements have more land in legumes and grasses, have higher crop yields, produce more and better quality hay and pasture, feed more livestock, have higher livestock production and returns, and secure larger net farm incomes.

In all comparisons the high-conservation farms had higher livestock efficiency as measured by "returns per $100 of feed fed." Does this fact reflect better livestock management or better feed? It can be argued, although our studies have not proved it, that better-quality feed supplies—grain, hay, and pasture— explain the greater efficiency. In getting progress in agriculture—and conservation farming represents progress—it is important to get farmers to adopt systems which, in the hands of the average operator, lead to progress. Systems that conserve soil and water bring higher crop yields, make the land easier to work, and provide better feed supplies, one of the fundamentals in more efficient livestock production.

Money spent on conservation is a sound investment. In addition to improving both present and future productivity, conservation practices usually increase the net income in one to four years, depending on the extent of needs. The returns provide a safe basis for establishing credit to put the conservation program into effect. Although the net income may be reduced temporarily, the productive value of the land increases immediately, protecting the financial position of the landowner until the long-time benefits of conservation can accrue. With our own as well as the world population increasing, investments in improving soil fertility, conserving soil and water, and controlling erosion should pay high dividends.

Building terraces in Missouri and Texas with Caterpillar diesel motor grader

Applications of Needle Bearings in Farm Machines

By Byron T. Virtue
MEMBER A.S.A.E.

THE literature available on bearings does not include a good and concise definition of a needle bearing, but, for purposes of discussion in this paper, the following description will be adequate: A needle bearing is one using a maximum complement of small diameter rollers without cages or spacers. The roller length, generally, is six to ten times its diameter.

Oddly enough the needle bearing has been thought of as a new development by many people. This may be the result of the rather recent and rapid expansion in its use. However, there was a text printed about the middle of the nineteenth century, in German, describing needle bearings of the loose roller type and many of the principles as they are used today. The first patents in this country involving the use of needle rollers of which we have record are dated 1839. Ellis D. Draper patented a keystoned needle-bearing sheave assembly in January, 1880.

Needle bearings may further be described by three different methods of application. The first to be used was the loose roller needle bearing without auxiliary races or retaining members, having a maximum complement of rollers surrounding a suitable shaft and in a suitable housing. This is true both in foreign applications and in our domestic uses. It is significant that the first to make extensive use of this type of bearing in this country was the automotive industry. The small diameter rollers readily lent themselves for use in both transmission and universal joint designs. It is to be noted that these designs represented two entirely different applications of the needle bearing. Universal joints represent oscillating motion through a small amplitude at high frequency. The transmission bearing represents an application at heavy load and rapid rotation. The industry demanded greater torque transmissions with the same or reduced size units, and found the capacity and life of this loose roller needle bearing the solution to their problem.

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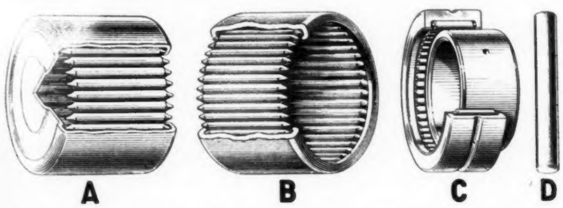


Fig. 1 Three common types of needle bearings: (A and B) Torrington closed-end and open end, drawn-cup needle bearings, respectively; and (C) the heavy race or NCS-type of needle bearing. (D) Spherical end roller, used in transmissions, etc.

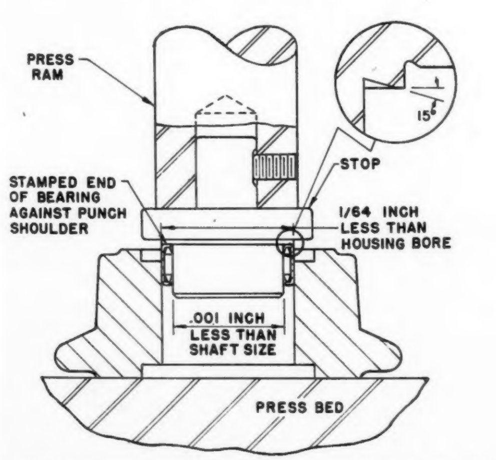


Fig. 3 Simple tools for installing Torrington needle bearings can be turned out easily in any toolroom. The use of proper tools speeds up assembly and prevents damage to the bearings

Because of the particular attention that has recently been paid to precision grinding of rollers, proper hardness and close internal clearances—both circumferential and diametral clearance—their general use has become more widespread.

The second step in development of needle bearings was the heavy ground-race type in which the full complement of loose rollers is retained and surrounded by a heavy hardened race having retaining shoulders or rings. This assembly further extended the use and advantages of needle bearings. Its construction will be recognized by Torrington NCS and other trade names such as Multiroll, Cyclops, and Roller Bushing.

The third type is a unit comprising an accurately drawn cylindrical cup surrounding and retaining the proper number of precision-ground, through-hardened rollers. It operates efficiently under either rotating or oscillating shaft motions. The hardened outer cup pressed into position in a properly machined housing forms an accurate cylindrical raceway for the rollers. This is the type that has rapidly expanded the use of needle bearings in all equipment because it incorporates all the advantages and makes them available in low-cost, easy-to-use units. Fig. 1 illustrates the three types.

The principles of all needle bearings and the method of describing the component parts for correct application are similar, and while the means of installation differ, the theory of the three types is identical. Load capacities vary and are

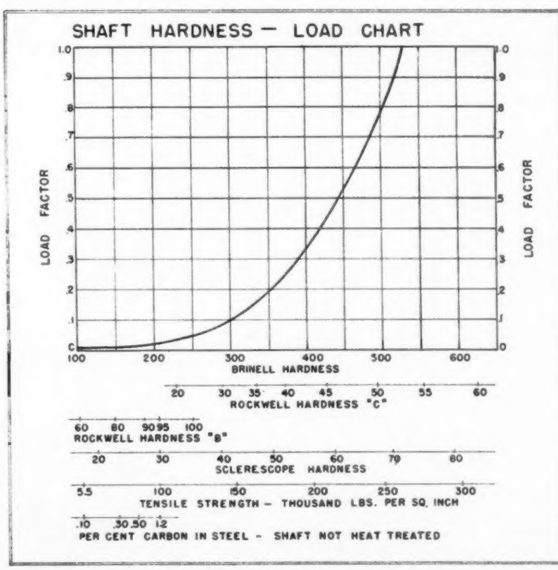


Fig. 2 This chart indicates the effect of shaft hardness in developing inherent needle-bearing capacity. This characteristic is most important when the economy of using the shaft as an inner race is considered

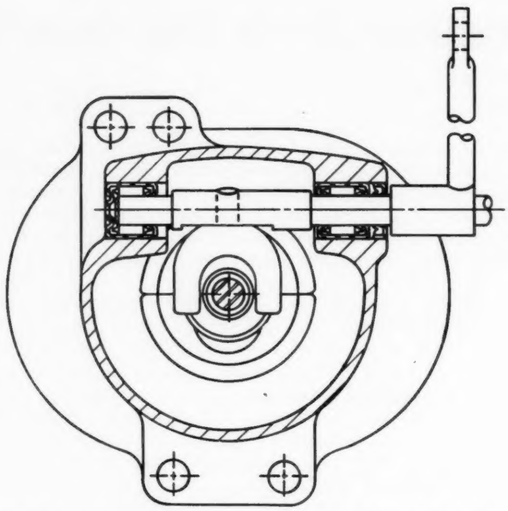


Fig. 4 Continuous sensitivity results from use of needle bearings in governors. Sluggishness and "hunting" are minimized

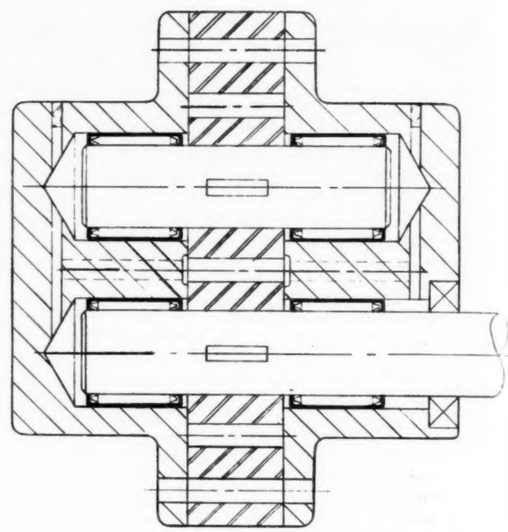


Fig. 5 Rugged gear pump service requires bearings with high radial capacity and small cross section

dependent upon the material used and the method of heat-treatment. Of the three types, the third seems to lend itself to widest application in agricultural equipment for reasons which will develop subsequently in this paper. It is also interesting to note, at this point, that agricultural equipment builders are now the second largest consumer of needle bearings.

The DC bearing is regularly furnished in two principal forms; that is, the open-end bearing identified by a prefix letter "B", and the closed-end bearing identified with a prefix letter "M". It can also be furnished with some variations which extend its use and application, such as an oil hole in the side of the cup, a grease fitting installed in the closed-end bearing, and, for purposes of corrosion resistance, stainless steel rollers and oxide black cups.

A "precision" or ground series is also available for the applications requiring lowest diametral clearance, highest order of concentricity, or maximum load conditions. This series is recommended in such applications as governors, fuel injectors, wrist pins, hydraulic motors, gear pumps, and in high-duty transmission applications. This drawn-cup type is also furnished with three sizes of rollers to accommodate different types of applications, as follows: (1) The "B" or regular series bearings having the largest number of small diameter rollers affording the greatest load-carrying capacity and a minimum outside diameter or housing bore; (2) the "BH" or large roller series which is similar to the regular series but has a smaller number of larger rollers and which lends itself to higher speed applications and is a more rugged bearing, adaptable to many implement and tractor applications, and (3) the "BL" series of the same construction as the other two, which has the extra large diameter rollers and lends itself to applications involving wide tolerances and rough usage.

It is always dangerous to try to set up criteria to use in selecting a series of bearings for a given type of application; however, some suggestions may help preliminary design.

The "B" or small roller series is adaptable for use in governors, control linkages, gear pumps, steering knuckles, bell cranks, and transmissions. The "BH" or large roller series is particularly suitable for pitman cranks, caster wheels, idler

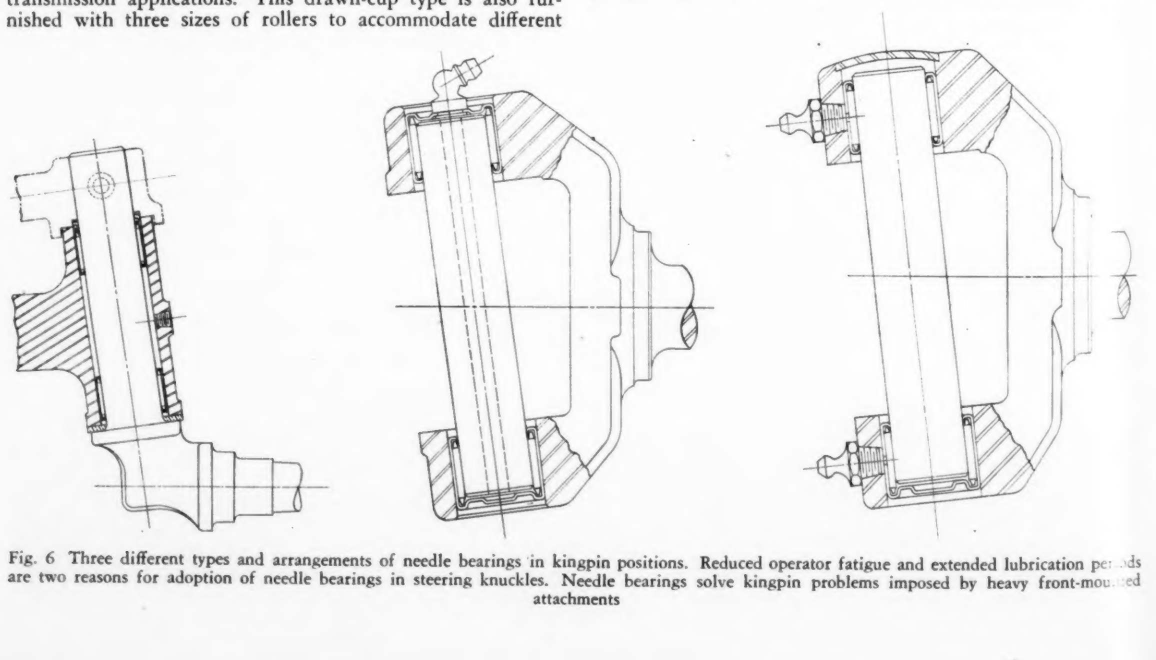


Fig. 6 Three different types and arrangements of needle bearings in kingpin positions. Reduced operator fatigue and extended lubrication periods are two reasons for adoption of needle bearings in steering knuckles. Needle bearings solve kingpin problems imposed by heavy front-mounted attachments

sprocket and pulley hubs, transmission and clutch pilots, rake tooth bar and crank positions, snapping and husker roller supports, and steady bearings. The "BL" or extra large roller series may be used in many of same applications where greater space is available and wider tolerance with rough usage is encountered.

There are three specifications usually emphasized in recommendations for use of needle bearings. They are housing bore, shaft size, and shaft surface hardness. The proper housing bore is significant, since it determines the proper roundness and circumferential clearance in a needle bearing.

The needle-bearing rollers should run directly on a shaft, having at least surface hardness, for most economical design. Therefore, the shaft size is important in order to get the proper diametral clearance. Instead of attempting to recommend press fits, etc., the proper housing bores and shaft sizes are specified for all of the Torrington needle-bearing series.

Since the shaft acts as an inner race, the user of the needle bearing should recognize that he is producing one of the three main elements of an anti-friction bearing. A satisfactory shaft can be produced comparatively easily by carburizing, furnace or induction hardening, and centerless grinding. A minimum case depth of 0.025 in after grinding is adequate for all but the most extreme load conditions. Hardened and ground inner races can be used for those positions where it is impossible to harden and grind the shaft.

Referring again to the shaft as an inner race, we can quickly see the reason for proper shaft hardening. A hardness of Rc58 minimum and Rc60 minimum is, normally, recommended for DC type and loose roller type, respectively. The inherent capacity of the bearing is not changed by the use of a low hardness shaft, but the life of the shaft itself acting as an inner race is much reduced. To help in understanding the diminishing capacities of soft shafts and how rapidly they change when the hardness of the shaft is decreased, Fig. 2 is presented. It will be noted that a regular cold rolled shaft of approximately 100 Rb will develop only 2 to 3 per cent of the actual needle bearing capacity.

The recommendation for housing bores provides 0.001 in tolerance and the tolerance for shaft diameter is 0.0005 in for the regular series. At first thought this seems to require prohibitively close work; however, by comparison with other types of high-grade anti-friction bearings these tolerances are most generous.

Some introductory remarks and information are always interesting, but the most important factors are the outstanding features that bear on design problems. Some of those features inherent in needle bearings are (1) high load capacity, (2) minimum housing extremity and maximum shaft size, (3) self-retainment, (4) lubrication problems simplified, and (5) over-all economy and simplicity.

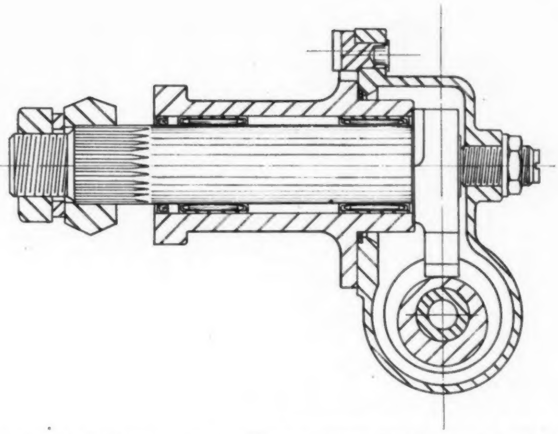
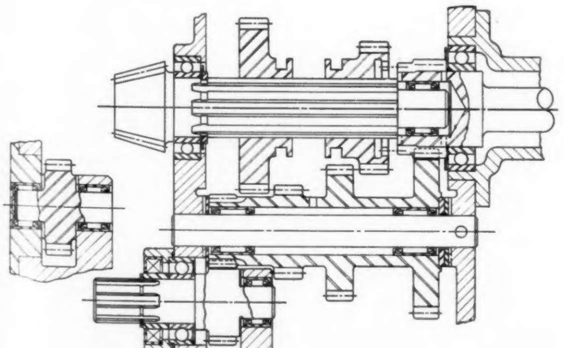


Fig. 7 Needle bearings on steering-gear pitman shafts maintain critical radial clearance and over-all gear efficiency

1 The needle bearing affords the greatest radial load capacity possible for a given housing bore. The bearing capacity is usually greater than surrounding and shaft members. Rigidity is necessary in order to maintain alignment and allow full capacity of the bearings to be developed. Experience indicates the load capacity of a bearing is limited by the housing and shaft deflections.

2 The use of a full complement of small diameter rollers, either of loose roller or unit assembly type, permits the minimum housing O.D. for a given shaft size or, conversely, allows the maximum shaft size for a given housing dimension. Experience dictates that, if the shaft deflection or shaft slope through the bearing is low and within our normal recommendations of 0.0005 in per inch slope maximum, the bearing will be adequate. Decreasing the housing dimensions reduces both weight and cost. Maximum shaft size in a given limited space often makes a design successful.

3 In this period of higher direct production costs, simple, easily produced, straight through housing bores for bearings are a definite advantage. Needle bearings will stay in position in a proper sized housing bore. No spacers, snap rings, or retaining washers are necessary. This feature, coupled with a new series of thin rind seals that fit into the same housing and on the same shaft as a needle bearing, definitely simplify machining operations. The low radial clearance of the needle bearing plus a hardened shaft for sealing surface are compli-



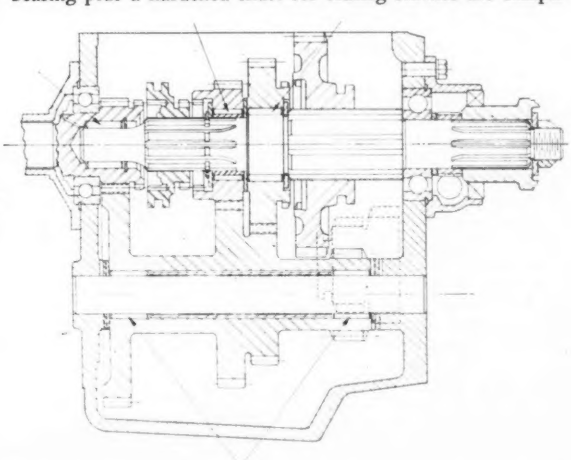


Fig. 8 (*Left and Right*) Torrington needle bearings and LN needle rollers both lend themselves for use in heavy-duty transmissions and gear-boxes for tractors and trucks, particularly for solving load, lubrication, and limited space problems in countershaft, cluster gear, idlers, pilot and reverse idler positions

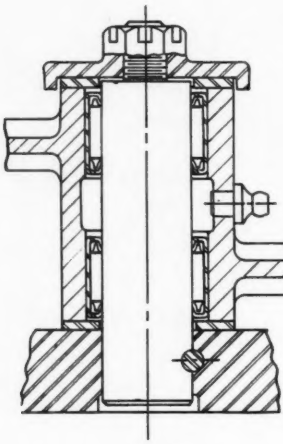


Fig. 9

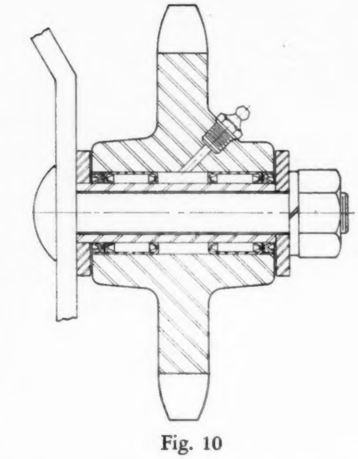


Fig. 10

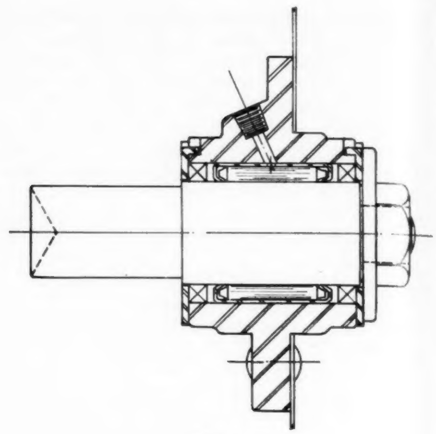


Fig. 11

Fig. 9 Bell cranks and pivot arms must have low radial clearance to perform their function of positioning and control. Bearing loads are extreme and lubrication is difficult. Needle bearings help in these applications • Fig. 10 Chain and belt tightener or idler design and manufacture are simplified by use of needle bearings • Fig. 11 Mower crankpin or pitman bearing life has been increased many times by the use of needle bearings in this difficult spot. The small section of the needle bearing, together with its high radial load capacity, lubricant retention, and relatively low cost, are a few of the features demanding its consideration

mentary to seal manufacturers' problems.

4 The turned-in lips of the outer cup have an inherent characteristic of retention of lubricant and exclusion of foreign matter. Like all anti-friction bearings, the needle bearing life is dependent on lubricant life, cleanliness, and good alignment. Oil is the best lubricant for needle bearings, but, in many cases, its use would be difficult and grease is used with good results. Many applications of grease prepacked bearings used under low speed and load conditions are very successful. A circulating oil system is desirable for high-load, high-speed conditions.

5 The use of straight-through housing bores with minimum housing proportions has been explained, as well as mention of easily produced, straight, hardened and ground shafts of proper section. These, coupled with simple means of installing needle bearings in bores with use of an inexpensive arbor press and punches or presser tools, make for an economical high production of relatively long life and trouble-free bearing service. Fig. 3 illustrates successful design for press attachment.

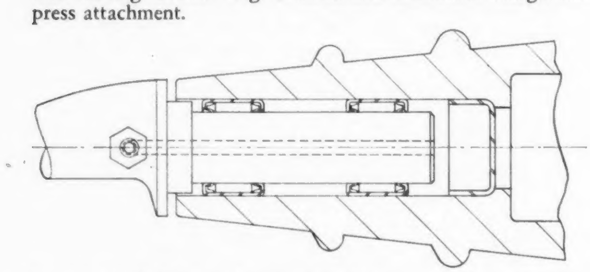


Fig. 12 Needle bearings fit into the limited space and carry the heavy loads of corn picker snapping and husking rolls

The typical applications illustrated in Figs. 4 to 14 serve to show the universality of the needle bearing in agricultural equipment.

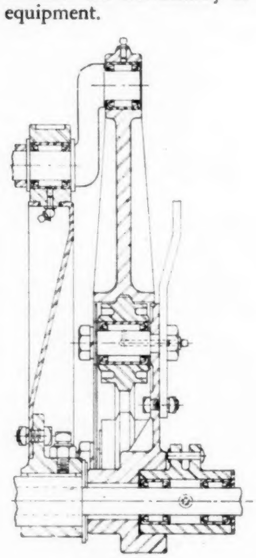


Fig. 13

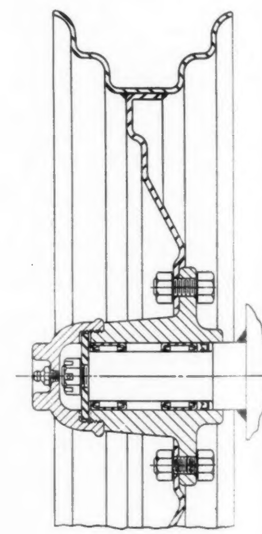


Fig. 14

Fig. 13 Needle bearings are being used successfully in all positions on side-delivery rakes, which include drives, eccentric rollers, tooth bar cranks, tooth bar arms, main cylinder hanger, transport and caster wheels • Fig. 14 Caster wheel and gage wheel loads are easily carried by needle bearings in simple, low-cost hub designs

Nation-Wide Farmhouse Research

By J. Robert Dodge
MEMBER A.S.A.E.

HOUSING for farm families has been the stepchild of research in farm structures for many years, and has been largely neglected by agricultural engineers in favor of research designed to provide better quarters for the so-called income-producing animals. Yet it is probable that humans are even more sensitive to their environment than are farm animals, and environment may well affect the productivity of the farm family and consequently the income of the farm. I make this point chiefly because the value of research is so often judged in terms of how much it will produce in the way of increased revenue, or save in dollars and cents. On the other hand, good housing contributes much more to the health, happiness, and general well-being of the average family than can be measured in terms of money, and it is time that housing for humans be given at least an equal place in agricultural engineering research programs with housing for livestock.

While rural housing research has been underway for a number of years, it has been on extremely limited funds, with the result that reliable information on even basic requirements for good farm housing is lacking.

For some time those concerned with the planning and design of rural homes have felt the need for more adequate information on how farm families live in different parts of the country; what activities they carry on in the house; how much space is needed for these activities, and for the necessary equipment and storage facilities, so that the activities can be carried on with maximum efficiency and freedom of annoyance and without wasted space. For years houses have been planned largely on the basis of personal experience, or observation, often limited in scope. It has also been common practice, when in doubt, to plan rooms and houses big enough so that there is little question that they will accommodate the activities which it is believed are carried on within them. This is like using a large factor of safety in designing a structural member when the properties of the materials are unknown. It is a safe but expensive method.

When funds for research were authorized under the Research and Marketing Act of 1946, an opportunity to undertake basic housing research on a regional and national scale, as well as within idividual states, was presented. Committees representing the state experiment stations, the U. S. Department of Agriculture, and in some cases, industry, were formed in each of the regions to decide what housing research should be undertaken. It is significant that in all four regions programs were outlined which included essentially the following major steps:

First, to conduct field studies to determine how farm families live, what activities must be provided for, what equipment and supplies are used in connection with the activities, and the families' preference for the general location of the activities.

Second, to determine functional requirements and develop practical standards for the amount of space and the most efficient and economical arrangement of space and equipment for the various activities, and for lighting, heating, ventilation, water supply, and waste disposal.

Third, to develop farmhouse plans based on the results of two preceding programs.

It was further agreed by all regions that step one should be undertaken first, since it would provide the information needed to undertake the second step, that of developing functional standards, and would also supply some information that could be used immediately in planning farm houses.

This paper was presented at the winter meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1948, as a contribution of the Farm Structures Division.

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The field study of the housing requirements of farm families is now underway. While the leadership in this study has been taken largely by the home economists at the state experiment stations and the Bureau of Human Nutrition and Home Economics (USDA), it is work that agricultural engineers and rural architects can ill afford to ignore. In fact, in two of the regions agricultural engineers have taken an active part in the program and have been represented on the technical committees which planned and coordinated the work. In all regions they have given advice and assistance in developing the schedules used in the study.

Preliminary work leading up to this study was begun by the Bureau of Human Nutrition and Home Economics, following a housing conference held in Chicago in the fall of 1944, at which all states interested in farm housing were represented. Following the conference Miss Maude Wilson of Oregon State College was loaned to the Bureau of Human Nutrition and Home Economics, to assist in the development of a master schedule for a field study. In the spring of 1945 this schedule was tested in pilot studies in Maine and Rhode Island in an effort to reduce the length. The development of a short schedule which would supply all of the needed information was a difficult task and two other pilot studies were made before a satisfactory schedule was produced. It was this schedule which was used by all four regions as a basis for the final regional schedules. Modifications were made to allow for regional differences but essentially the same data will be obtained throughout the country.

The information that will be obtained is for the most part factual, although questions as to the families' preference for certain features are included. The following is a summary of the types of information which will be secured:

1 *General information*, including size, composition, type and economic status of family, type and size of farm, and education of homemaker and male head of family. This type of data is needed in analyzing the information on family activities. It also serves as a basis for checking the accuracy of the sample.

2 *Information on the present dwelling*, including number of stories, number and kinds of rooms; installed facilities, such as running water, electricity, and heat; types and sizes of equipment, such as cooking ranges, laundry equipment, refrigerators, and freezers, and in addition any such equipment which the family intends to purchase within the next two years. Also obtained will be the kind and amount of furniture the family has or intends to purchase. This data will aid in evaluating preferences expressed for various housing features, and will provide information on the satisfaction given by features found in existing dwellings. The information on equipment, utilities, and furniture, is of course necessary in determining space requirements.

3 *Information on activities carried on in the house*, the frequency with which they are performed, the magnitude and the importance of the activity, and the family preference for the location of the activity. This will, for example, supply data on such activities as food preservation, home baking, meal preparation and service, laundry, farm tasks performed in the home, entertaining, and farm and household business. This information will form the basis for studies to determine space requirements and the efficient arrangement of areas within the house.

4 *Information on families' preferences for general housing features*, such as the number of stories in the house, whether a basement is wanted, location of place for men to wash up, location of bathroom in a two-story house, preference for a first floor bedroom in a two-story house, number and kind of porches, preferences for fireplaces, types of fuel and heating equipment.

5 *Inventory of possessions,* which will give data on the amount and kinds of food to be stored both for long periods of time and for immediate use, and the amount and kinds of clothing, and other possessions requiring storage. This data will be used in determining the types, amount and location of storage facilities, which are now very controversial subjects.

In developing the schedule, every effort was made to avoid leading questions or questions which might not give an accurate picture of housing needs. The questions involving preference were confined as much as possible to those features with which families were sufficiently familiar to express a valid opinion. In addition, checks were provided in the form of questions which would enable architects or engineers using the data to evaluate expressed preferences with relation to the families need and ability to pay for preferred features.

Nevertheless, preference is an important consideration in housing. It is impossible to consider the farmhouse in the same terms as the service buildings, where the chief considerations are maximum efficiency and durability, at minimum cost. Esthetics and concern for the other than purely material needs of the family, are essential considerations. Too little attention has been paid to those aspects of housing in the effort to get shelter at low cost.

REGIONAL CONDUCT OF HOUSING STUDY

The conduct of this study has varied somewhat in the different regions. In all four regions the Master Sample of Agriculture was used and the sample drawn by the Iowa State College Statistical Laboratory. In all but the North Central states the regions were broken down into subregions in order to secure a picture of the effect of climate, topography, type of farming, and proximity to urban areas, on housing requirements within the region. However, because of greater uniformity in conditions this was believed to be unnecessary in the North Central states. In all but the Southern region samples were drawn from every state in the region. In the South no work has been done in Florida, Texas, Louisiana, Oklahoma, North Carolina, or Kentucky. Data in all regions will be machine tabulated. This will of course make it possible to break down the data in a wide variety of ways and to easily secure many different combinations for purposes of analysis.

At the present time the field work has been completed in the Northeastern and North Central regions. The coding, punching, and tabulating of the data are being done by the Iowa State College Statistical Laboratory for both of these regions, and it is expected that at least preliminary reports will have been completed by June 30, 1949.

Field work in three of the six subregions of the South has been completed, and it is hoped that it can be finished in the remaining subregions by January 1, 1949. In the Western region field work has been finished in all states but Arizona, Nevada, and New Mexico, and plans call for the completion of the work in these states by January 1, 1949.

When field work has been completed, a total of approximately 4,000 schedules will have been taken throughout the country, which will give a good cross section of the important farming areas. Preliminary checks on the accuracy of the sampling in the North Central region made by the Iowa State College Statistical Laboratory indicate that all items when compared with similar census data check within 5 per cent, except for the number of electrified homes, and the number of homes having running water. These items were from 6 to 9 per cent higher than the census figures, which might be expected since there have probably been many installations since 1945.

While results are not yet available from the field study, it is interesting to note that those engaged in working with the data have commented that the living patterns of farm families in their regions were different from what they had thought them to be.

Step 2 in this program, which will include research to determine space standards and arrangements of spaces and equipment, can best be carried on under controlled laboratory conditions where the various household activities can be performed and each operation observed and analyzed in relation to space dimensions and the arrangement of equipment and storage facilities. It is also desirable that those operations, which are normally carried on at the same time or are otherwise interrelated, be studied together and that special attention be given to the multiple use of activity areas to avoid unnecessary space. It has been proposed that laboratory facilities be such that complete houses can be set up using movable wall panels and equipment so that space dimensions can be easily adjusted and different arrangements studied within a comparatively short time and at a minimum of expense. Such studies cannot be carried on easily or economically in a conventionally built house because of its relative inflexibility.

Such laboratory facilities will also make it possible to set up and test complete house plans before they are made available to farmers. The reactions of people to new features or to various sizes and arrangements of rooms can thus be determined with some accuracy, since few people can visualize what a house will be like by looking at a plan on paper. This is particularly true with regard to the more intangible qualities of housing.

At the present time housing laboratories which would provide for this type of research are contemplated by both the Southern and the North Central regions. The Northeastern and Western regions, on the other hand, propose to break down the studies of space requirements by activities and carry on work at several different institutions. Later the results of the individual projects can be brought together and studied in relation to the house as a whole.

These laboratory studies are of equal importance to rural architects, agricultural engineers, and home economists, and must be carried on in close cooperation if they are to be successful. Home economists have the training and background needed to carry on the studies to develop space standards for the individual household tasks, while rural architects and agricultural engineers are in a position to view such studies objectively and analyze the results with relation to the arrangement of the rooms and the house as a whole, and particularly in relation to the structure and utilities.

HOUSING PROJECTS UNDERWAY IN THE STATES

In addition to this nation-wide program, projects dealing with other aspects of housing are also underway in a number of states. Some of these are in effect extensions of the regional project, while some deal with other aspects of housing. A regional project which will contribute to improved farmhouses as well as other farm structures, is the project on the "Selection and Utilization of Materials for Farm Building Construction". This is being carried on cooperatively by the state agricultural experiment stations of the North Central region and the Bureau of Plant Industry, Soils, and Agricultural Engineering. This project has as its objectives:

1 To establish service and design requirements for floors, walls, roofs, and other components of each of the principal types of farm buildings

2 To compile or secure data on physical, chemical, and related properties of building materials, structural parts, and assemblies, as related to farm building construction.

3 To evaluate the performance of existing and new materials in actual use on farms

4 To improve fabrication methods and construction procedures.

At present work is well underway on the second objective. The work that has been done on objective 3 consists largely in developing a questionaire, but field work is expected to get underway shortly.

Two other field studies have also been made recently in the Department. One is an enumerative survey, in April, 1948, which was conducted by the Bureau of Agricultural Economics. One section gives information on the value of farm construction by types of buildings, which includes farm houses. The other is a study of house improvement practices of owner-operator families, conducted in four North Central states by the family economics division of the Bureau of Human Nutrition and Home Eco- *(Continued on page 258)*

Observations on Farm Building Activity

By Wallace Ashby

MEMBER A.S.A.E.

A PICTURE of farm building activity in the United States should include 7 million dwellings and 27 million people. In the absence of statistics we may estimate that there also are about 6 million barns and 20 million other permanent structures, housing 25 million cows, 60 million hogs, 525 million chickens, and large numbers of other livestock. The buildings provide seasonal storage for about 5 billion bushels of grains and seeds, 50 million tons of hay, and 40 million tons of silage. A large part of the 500 million bushel production of potatoes, sweet potatoes, apples, pears, and other late vegetables and fruits is stored on the farm or in community storages controlled by farmers. Farmers' investment in land and buildings as of January 1, 1948, was estimated at about 63 billion dollars. Assuming that buildings, including dwellings, represent 30 per cent of this amount, as was the case when the 1940 Census was taken, their value would be about 20 billion dollars.

In a press release dated December 10, 1948, the Bureau of Agricultural Economics gave out the following information:

> "The building business is booming on farms as well as in urban areas, according to the results of a personal interview survey made by the Bureau of Agricultural Economics in April, 1948. Of nearly 12,000 farmers interviewed, four per cent reported new houses started or completed on their farms during 1947. With approximately 6,000,000 farms in the United States, this rate would indicate that new houses were under construction on about 240,000 farms. However, part of these houses that were finished in 1947 were started in 1946 and part of those begun in 1947 were not completed until 1948. Assuming an average construction period of six months, and that building continued with fair uniformity around the year, it appears that construction of farm homes was begun on from 150,000 to 170,000 farms in 1947.
>
> "More farm families reported that they repaired or improved their existing homes than reported any other phase of farm building. Twenty-three per cent reported that houses were repaired or remodeled during 1947, but only 15 per cent reported repairs or remodeling of other farm buildings. New buildings other than houses were built on 13 per cent of the sample farms.
>
> "Slightly more than two-fifths of the farmers interviewed reported that construction work of some kind was done on their farms during 1947, with many indicating both new construction and renovation of existing structures. Construction work of some kind was probably done on about two and one-half million farms. Applying the survey rates of construction to the total number of farms in the United States indicates that existing houses were repaired or remodeled on somewhat less than one and one-half million farms; that new buildings other than houses were under construction on about 800,000 farms; and that existing structures other than houses were repaired or remodeled on around 900,000 farms.
>
> "A much higher percentage of farmers in the South and West reported new houses built than in the North, but repairing and remodeling of houses occurred more frequently in the North than in the South. New building and repair work of all kinds was reported on a larger per cent of northern farms than southern farms, and such work in the western states was almost as important as in the North. Except in the north central states, more farms reported work on houses than on other buildings."

This survey included very small and part-time farms as well as commercial farms. It indicates that about 5,900 houses per million of farm population were begun in 1947. This compares with a rate of about 7,300 non-farm houses per million of non-farm population in the same period.

How do 150,000 to 170,000 farmhouses built in 1947 compare with prewar? The 1940 Census enumerated 719,000 houses built in the 5.2-year period from 1935 to the time the Census was taken. Making allowance for losses by fire and for houses for which the year of building was not reported, we may assume an average rate of about 140,000 new farmhouses built per year for that period. Also, taking into consideration the average life and the estimated number of barns and other farm buildings as compared to farmhouses, we may estimate that about 140,000 barns and 600,000 other buildings per year were built from 1935 to 1940. Thus the 1947 rate of constructing *new* farm buildings does not appear much higher than the prewar or normal rate. The backlog of needed work is larger, but scarcity and high costs of skilled labor and of materials have retarded new construction. I believe, however, that the amount of repairs and remodeling in 1947 was considerably more than in the prewar period.

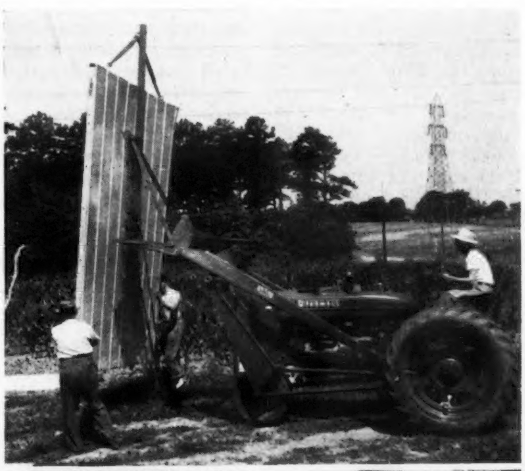

Fig. 1 (*Top*) Prefabricated steel panel being moved into place by a tractor with manure-loader attachment. (Photo from N. C. Teter, North Carolina State College) • Fig. 2 (*Bottom*) Lifting roof trusses into place in one-story barn using farm tractor with hoist attachment. (Photo from M. S. Klinck, University of Connecticut)

KINDS OF FARM BUILDING ACTIVITY

All available information indicates that the greatest activity is in building, repairing, remodeling, and equipping farmhouses. Many more houses were remodeled than were built new, and a large number were improved through installation of electricity, water systems, kitchen equipment, bathrooms, sewage

This paper was presented at the winter meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1948, as a contribution of the Farm Structures Division.

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ACKNOWLEDGMENT: This paper utilizes information received from members of the field staff of the USDA division of farm buildings and rural housing and agricultural engineers on the staffs of many of the state agricultural colleges or connected with the building materials industry. Other sources of information include a survey of farm building activity released in December, 1948, by the Bureau of Agricultural Economics, other government publications, magazine articles, and personal observation.

disposal, heating equipment, or insulation. Many of the new houses have concrete floors and masonry walls, cinder and other lightweight aggregate blocks being much used. However, at least in some sections, there is now a trend back to wood construction as good lumber again becomes available and cement is scarcer.

Next in importance to improvement of farmhouses has been improvement of dairy barns and milkhouses to meet Grade A requirements. Old dairy barns are being improved and ventilated and some new two-story barns are being built, though with smaller mows than the older barns. In other cases old buildings not suitable for stanchion barns are being remodeled for loose housing and many new milking stables and milkhouses are being built. Home-sawed lumber has generally been used where available but shortage and cost of shipped-in lumber have favored the use of masonry blocks, especially those made with cinder or other lightweight aggregates. In the West there is much use of pumice and other volcanic material for concrete aggregate. Metal roofs are in great demand and aluminum and aluminum-painted roofs are becoming a prominent feature of the countryside. In barns for loose-housing of dairy cows as well as of beef cattle there is demand for trussed roofs or steel beams to eliminate close-spaced posts and girders that interfere with tractor loading of manure. There is also growing use of paved lots and lanes to keep the animals out of the mud. In areas of heavy poultry and egg production a good many new broiler and laying houses have been built and many older buildings have been repaired and improved. In the corn and wheat belts the number of new permanent cribs and granaries of conventional type is about average, but fabricated metal buildings for these purposes are being introduced. Some buildings used for corn storage have tight walls and are equipped with blowers and ventilating ducts. There is a rapidly growing interest in mechanical drying of corn, small grain and hay, and farmers want improved designs for buildings adapted for use of drying equipment. In the corn belt a large number of new semi-permanent and temporary corn cribs have been built to handle the tremendous 1948 crop. Also, in the corn and wheat belts many new machine sheds and shops have been built. Arch-roof, metal-covered buildings, with either steel or laminated wood ribs, are coming into general use for these purposes.

In addition to strictly farm buildings, there has been in some areas considerable activity in trackside storages; for example, potato storage in Maine, apple storage in Washington, rice storage in Texas. In Utah there are at least two co-operative milking parlors, each handling 200 to 300 cows.

Increased attention is being paid to reduction af labor about farm buildings, especially in livestock buildings, by installation of electric lights, water systems, milking machines, improved types of self-feeders and feed bunks, mechanical feed handling and conveying equipment, silo unloaders, manure cleaners, poultry waterers, and similar devices. More efficient layouts to reduce time and steps in feeding operations are being introduced, with important savings in time and distance walked. Indirect evidence of accomplishment through these improved practices is found in the fact that farm output per worker in 1948 was 44 per cent greater than in 1940. Part of this improvement no doubt came from greater efficiency in doing chores, though bumper crop yields and improved field machinery must be given the largest shares of the credit.

QUALITY OF BUILDINGS

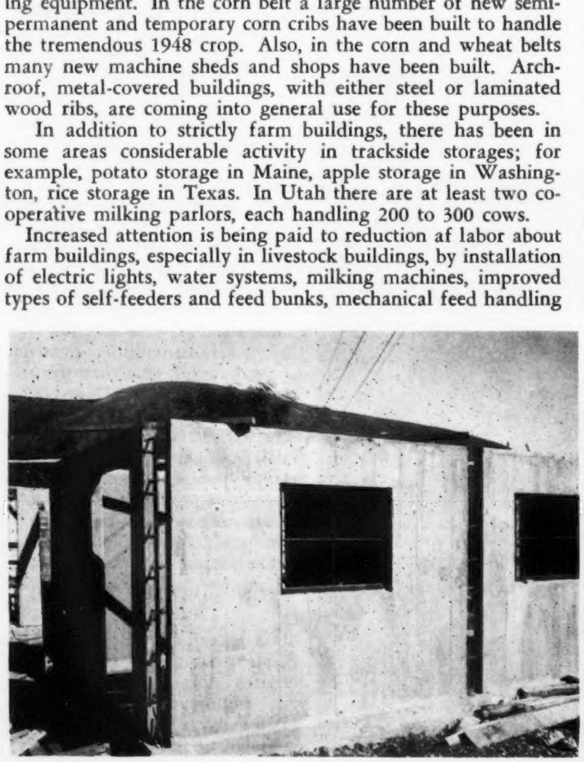
A number of comments on the quality of the new buildings were received. Most agreed that design is better than prewar in respect to layout and convenience, though farmers are not making enough use of the improved plans and other planning aids offered through the state extension services. As an illustration, one of my friends was interested in correspondence with a farmer in West Virginia who obtained one of the new house plans for the Northeast Region and was going to build it. Some months later my friend was passing near this farm and stopped to look at the new house. He found that the plan had not been used because the owners were afraid the local carpenters could not build it satisfactorily. Instead they built a house which the carpenter considered cheaper and easier to build. It is roomy but not particularly well arranged for farm living. The tendency of country builders to do things the old way rather than the new is also illustrated by a story from Wisconsin. An owner had shown a carpenter working drawings for his new building. The carpenter told him, "These are your dreams. Take them home and sleep with them, I'll do this my way".

Comments from a number of agricultural engineers indicated that the quality of much of the material being used is only fair. Green lumber and poor quality concrete blocks received special mention. In some cases dealers sell materials and equipment not suited for the particular farm use, either because manufacturers do not properly instruct the dealers or because of too great eagerness to make sales.

Workmanship also is only fair and in some cases materials are not properly installed. While there are a good many contract jobs, especially on silo construction, plumbing, and spray painting, the general practice is to hire a carpenter to lay out and do the more exacting work, and to use family or farm labor for hauling and excavating and for rough carpentry and other semiskilled work. The use of family labor for these purposes seems to be at least as general as before the war.

CHANGES IN BUILDING TYPES AND CONSTRUCTION METHODS

A number of innovations in building types and materials are making rapid headway. Trial of the loose-housing, milking-



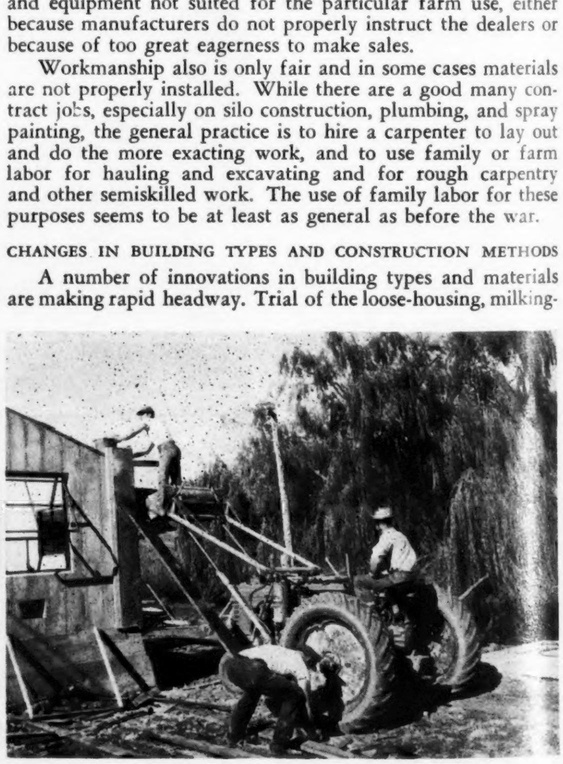


Fig. 3 (*Left*) Corner of dairy barn wall. Panels are cast flat, then hoisted into place with a derrick. Reinforcing rods are welded together and gaps in the wall are filled with concrete • Fig. 4 (*Right*) Use of tractor-mounted manure loader to lift man and bucket of concrete to fill gaps in wall shown in Fig. 3. (Photos from C. F. Kelly, Division Farm Buildings and Rural Housing, USDA)

stable system of handling dairy cows in the northern states is an example. Another is the arch-roof, metal-covered building of either quonset or laminated-wood, arch type already mentioned. In the case of the quonset the manufacturers are finding ways to adapt a few standardized types of buildings for many farm uses, including dwellings, dairy barns, hog and poultry houses, grain storages, machine sheds, and the like. The advantages of adapting a standard building to several uses are not confined to the prefabricated building since standardization of any type of building would simplify construction and reduce the variety of materials carried by local dealers. Another noticeable trend is in the use of poultry houses 36 ft or more in width and two or more stories high, where large laying flocks are to be housed in the commercial areas. Such buildings are more economical to construct and easier to maintain at desired temperatures and humidities than narrower buildings. The use of creosoted poles set in the ground to avoid use of a foundation for barns and sheds considerably reduces cost in some cases.

There is a great increase in the use of insulation in dwellings, livestock buildings and storages for fruits and vegetables. However, techniques of proper insulation are not well understood and faulty installations may cause much disappointment after the buildings have been in use. The insulation value of lightweight aggregate concrete and of various other materials is no doubt overrated by many farmers.

The advantages of plywood, cement-asbestos board, gypsum products and other relatively new materials are being recognized, and we may expect that these products will find general use as supplies improve and farm builders learn to handle them.

A gradual change in methods of construction is taking place. Bulldozers or tractors with scoops are much used for excavation of cellars, trench silos, and to level building sites and grade lawns. Machines are used to dig trenches for water pipes, sewage-disposal tile lines, and post holes. Tractor-mounted manure loaders with various modifications are used to a small extent to handle materials and to tilt up precast concrete panels or lift prefabricated panels or roof trusses into place (Figs. 1 to 4). In view of the large number of tractors on farms it seems that there is much more room for development along this line, either to adapt building designs to power operations or to develop attachments for tractors and other farm machinery so that they can be used for building purposes.

Use of concrete mixers is general and some ready-mixed concrete is used near cities. The use of electric saws is becoming common. Occasionally one hears of a neighborhood barn raising. A report from Michigan states that in two counties alone more than 100 barns have been put up in this way with considerable saving in expense and no doubt plenty of excitement and good times.

COSTS

Agricultural engineers generally estimate that present farm building costs are at least twice prewar. (Size of building is an important factor affecting unit cost; the larger the building, the less the cost per unit.) Here are some examples of recent costs.

Farmhouses, one-story: Pa., \$10 - \$12; Mo., \$8 - \$12; Colo., \$9 - \$12; Calif., \$9 - \$11 per sq ft.

Milking stables with attached milkhouses, concrete floors, and equipment: Mo., \$2.50 - \$3.00 per sq ft; \$325 to \$425 per stall; N. C., 6-stall barn, \$983 to \$1611, plus \$400 average for equipment (see N. C. Ext. Circ. 324); Calif., \$2.20 per sq ft.

Stanchion barns, with mow: N. J., 40-cow, \$250 - \$300 per stall; Wis., bank, 23-stall, \$4.20 per sq ft, plus farm labor and materials; Minn., \$3.00 - \$5.00 per sq ft.

Poultry houses: N. J., \$3.50 - \$5.00; Mo., \$4.00 - \$8.00; Ga., about \$5.00 per hen.

Cattle sheds, open front, earth floor: Utah, \$.75 - \$1.00 per sq ft.

Silos, above ground, with roof and chute: Wis., concrete, 100-200 ton, \$7 - \$9 per ton; Oregon, wood, 70-ton, \$9 - \$14 per ton; concrete, 70-ton, \$17 per ton.

Double corn cribs with overhead bins: \$.90 - \$1.20 per bu. of corn; \$.45 - \$.60 per bu of small grain.

Prefabricated steel buildings, 24 x 40-ft, bin partitions, concrete floor: N. C., \$4.00 per sq ft.

Quonset buildings for ear corn, 32 x 36-ft, including fan and motor: \$.80 per bu.

Quonset building for small grain, 40 x 100-ft, \$.25 per bu.

Shop and storage building, 24 x 116-ft, with floor; N. C., \$1.45 per sq ft.

Apple storages, large: Wash., \$.33 per sq ft; \$1.00 - \$1.50 per box.

Machine sheds, not including shop: Minn., \$1.25 - \$1.50 per sq ft.

A number of agricultural engineers are much concerned about these high costs, feeling that to build at present costs places an unreasonable future burden on the land. On the other hand, farm building costs in November, 1948, were relatively no higher than farm prices, building material prices being 247 per cent and farm prices 253 per cent of the respective 1935 to 1939 averages. High labor costs appeared to be offset to a considerable extent by greater use of family labor. Farmers are in sound financial position with the highest income in history and owe debts of only 10 cents per dollar of their present worth. Their liquid assets have been tripled since 1940. Thus they are in position to rebuild their physical plants when they think they can do so to advantage.

AGRICULTURAL ENGINEER'S RESPONSIBILITY

To sum up the preceding discussion, the amount of new building on farms is above prewar average, but not enough to replace the great number of obsolete buildings very soon. Repairs, remodeling, and installation of labor-saving equipment are at a high level. Quality of construction is only fair and costs are about twice prewar, though about in line with farm prices and income. In view of the need for more good buildings, the present high costs of building and the declining trend of farm prices and incomes, agricultural engineers may well ask, "What can be done to assist farmers in obtaining better value for their building dollars?"

As agricultural engineers know, funds for research on farmhousing, dairy buildings, and crop conditioning and storage have been considerably increased in the past year by allotments under the Research and Marketing Act. A good start is being made in determining the functional requirements of buildings and equipment. Much still needs to be done to improve designs for farmhouses, other buildings, and the farmstead as a whole. Water supply, sewage disposal, lighting, heating, and other problems also need study. In my opinion, the most urgent research need is for more intensive studies of the use of materials and of construction methods, with particular attention to the use of power equipment in order to lower costs of all building elements.

Farm building research has been hampered by lack of funds to test and demonstrate new developments in actual construction. In most cases the research engineer is dependent on finding a farmer who is willing to take the risk of pioneering the new idea. Progress would be facilitated if there were some way for a public research agency to bear part of the cost of a farmer's building when it incorporated features to be tested in a research program. Such buildings would serve both as laboratories and as demonstrations to other farmers, carrying much more weight than bulletins or plans.

The Extension Service will no doubt be called on to give much more attention to farm building in case a farm housing bill is passed by Congress and funds for technical services are appropriated. Senate Bill S.866, which passed the Senate in April, 1948, but failed in the House, carried the following provisions: "Sec. 705. In addition to the financial assistance authorized in sections 701 to 704, inclusive, the Secretary is hereby authorized to furnish to all persons, without charge or at such charges as the Secretary may determine, technical services such as building plans, specifications, construction supervision and inspection, and advice and information regarding rural dwellings and other farm buildings. The Secretary and the Housing and Home Finance Administrator are

authorized to cooperate in research and technical studies in the rural-housing field. In furnishing such services and information, the Secretary may utilize, through the Agricultural Extension Service, the facilities and services of state agencies and educational institutions".

Extension Service reports of extension activities and accomplishments for 1945, 1946, and 1947, give the following information:

Thousands of families assisted in —	*1945*	*1946*	*1947*
Constructing dwellings	25	45	48
Remodeling dwellings	69	110	108
Installing sewage systems	16	33	42
Installing water systems	23	41	50
Installing heating systems	9	21	25
Providing needed storage space	171	209	223
Rearranging or improving kitchens	159	232	240
Construction of farm buildings	63	68	76
Remodeling or repairing farm buildings	74	79	85
Selection or construction of farm building equipment	49	47	53

In connection with this program, a large number of building plans, probably between 300,000 and 400,000, were furnished by the extension services of the 48 states.

While the above record is encouraging, especially in view of the heavy load carried by county agents and the fact that there are only 69 agricultural engineers assigned to farm buildings at the state extension level and that most of them also carry other projects, it is evident by reference to the Bureau of Agricultural Economics report quoted at the beginning of this paper that not nearly all of the farmers who built or remodeled in 1947 were reached by extension workers.

APPROACH TO BETTER FARM BUILDINGS

Following are some lines of approach to better and cheaper farm buildings that I believe deserve the cooperation of research, extension, and teaching staffs and industry:

1 The program of dimensional coordination of building materials and building design that is being developed and promoted by the American Standards Association as Project A-62 in cooperation with manufacturers, architects, and others. This program, together with standardization of building widths and heights, offers real possibilities of savings on the farm by reducing waste and labor in cutting materials. The Bureau (BPISAE) and the northeastern states have cooperated by preparing all of the working drawings for the houses and other buildings in the Northeast Plan Exchange in accordance with the A-62 standards. However, farmers will get little benefit from these improved designs unless country carpenters and builders are willing to work to the drawings. That is a matter for serious consideration by teachers, extension workers, and industry.

2 Encouragement of farm building contractors. Agricultural engineers in several parts of the country call attention to the need for contractors who know how to design modern farm structures and build them properly. This need is more apparent than before the war as costs of construction by other methods have risen and farmers, especially those in the commercial farming areas, are financially able to contract for building construction. What can be done to make this field more attractive to young agricultural engineers?

Standardization of building types, widths, and heights, together with the coordination of material sizes referred to above, should be of especial assistance to contractors in reducing the amount and variety of work to be done at the site and permitting use of standard and precut parts, movable concrete forms, and other labor-saving practices. Reduction of man-hour requirements at the site would help to offset the scattered location and comparatively small size of farm jobs. College training courses in farm building types and requirements, construction techniques, use of labor-saving equipment, business methods, and related subjects should help to interest young men and prepare them for this type of work. Lack of capital, however, might prevent many from entering the contracting field. Would the building materials industry extend credit to assist men with such training and some practical experience to get started as farm building contractors? Is this a subject that should be studied by an ASAE committee?

3 Use of home-cut lumber and farm labor to reduce costs and expedite building. These practices, as well as the use of local stone, gravel, and in some sections, earth, are traditional on farms, though the quality of the resulting building often is not entirely satisfactory. These practices are particularly valuable in areas of relatively small farm operations and low cash income. Research methods applied in connection with actual building operations should develop ways of using native materials and farm labor, power and machinery more effectively and economically. Farm boys and country builders need training for greater appreciation of good design and workmanship and to have greater skill in all sorts of building operations. I hope that extension, vocational agriculture, and the building materials industry will support such programs. Experience, especially Deane G. Carter's work in Arkansas, has shown that so much more building is done when full use is made of these farm resources that the demand for purchased materials is greater than if no native materials were used. Thus both farmers and dealers are benefited.

Nation-Wide Farmhouse Research

(Continued from page 234)

nomics. The field work on the study is completed and the data are now being analyzed.

That funds for research in rural housing will continue to be available seems probable. In fact, an expanded program covering all aspects of rural housing is a distinct possibility. The Housing Act of 1948, better known as the Taft-Ellender-Wagner Bill, which passed the Senate, but not the House, at the last session of Congress, would have specifically authorized research in the rural housing field. In addition the bill would have authorized the Secretary of Agriculture "to furnish to all persons without charge or at such charges as the Secretary may determine, technical services such as building plans, specifications, construction supervision, and inspection, and advice and information regarding rural dwellings and other farm buildings". Furthermore, in furnishing such services and information the Secretary would have been authorized to "utilize, through the Agricultural Extension Service, the facilities and services of state agencies and educational institutions".

A big national program would of course throw a considerable responsibility on agricultural engineers, rural architects, home economists, and others in federal and state agencies concerned with rural housing. It is therefore important that they be prepared to assume such responsibilities.

One Guiding Principle

I HAVE spent the greater part of my working life in scientific endeavors and I have learned by hard experience one guiding princple common to all scientific researches — *never to discard the results of a well-demonstrated experiment in favor of an hypothesis that denies those results.*

That principle is no less valid in economic and political than in scientific fields. We in the United States launched, some 160 years ago, an experiment in government and economics. While the results have not been perfect, it is nonetheless true that the experiment, by any test that could be applied, has turned out successfully — so successfully that it has never been matached in the long sweep of history in giving such great benefits to such a multitude of people.

Set off against this experiment, we see theories which maintain that our system holds out no hope for humanity, that the only chance for the world — for the United States itself — is to turn to increasing control and domination by government . . . Even if these concepts were only theoretical, we should not be justified in allowing them to persuade us to discard the successful results of our experiment. — *Excerpt from an address of Crawford H. Greenewalt, president, E. I. Dupont de Nemours and Co.*

The Use of Ultrasonic Energy in Agriculture

By Lowell E. Campbell and L. G. Schoenleber
JUNIOR MEMBER A.S.A.E. MEMBER A.S.A.E.

ULTRASONICS is the name given to sound radiations above the normal audible limit. The term "supersonics," although having the same definition, is currently being used to denote velocities greater than the speed of sound in air, as for example the speed of faster-than-sound jet aircraft.

The first reports on ultrasonics came from late 19th century investigators who experimented to determine the upper limit of human hearing. In World War I research was directed toward the use of ultrasonic waves in underwater communication systems and in submarine detection systems. Following the first World War a few scientists ventured to investigate the physical and biological effects of high-intensity ultrasonics. Wood and Loomis [1*] reported on one of the first high-intensity generators in the United States in 1927.

During World War II, greater advances were made in many phases of ultrasonic generation and following the war the results of the wartime research and use become known to the scientific world. At present, half a dozen material-testing devices that utilize ultrasonics are being marketed. Several manufacturers are producing high-intensity generators for experimental work. Most of the experimental investigations have been outside the field of agriculture, very little of the wartime research being directed toward biological effects.

The scope of ultrasonics covers the same wide variation in frequencies as does electrical radiation. They have a type of wave propagation similar to electromagnetic radiation but differ in being essentially mechanical vibrations. The phases of ultrasonics now being explored by scientists include but a small section of the total ultrasonic frequency range.

Properties of Sound Waves. Sound waves have three major dimensions: frequency, velocity, and intensity.

Frequencies from 16 to about 20,000 cycles per second may be sensed by the average human ear. The frequencies above 20,000 cycles to about 10,000 megacycles per second define the ultrasonic range. Frequencies above 10,000 megacycles have been classed hypersonics. Frequency and pitch are identical in most respects; in the audible region the frequency may be observed by a sensing element, such as a microphone and amplifier attached to a speaker or to a cathode ray oscilloscope. Higher frequencies produced by radio-frequency oscillations result in ultrasonic vibrations that have the same frequency as the radio frequency oscillations, which can easily be measured.

The velocity of sound waves is determined by the medium in which they originate and travel. Sound in air travels about 1,100 fps, depending mainly upon the temperature. In solids and liquids the speeds are generally much greater.

Intensity, or the loudness, determines the energy content of the sound wave. Intensity is proportional to the amplitude and is sometimes expressed in watts per square centimeter. Intensity at low frequency is measured in decibels.

This paper was presented at the winter meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1948, as a contribution of the Rural Electric Division.

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* Superscript numbers refer to appended references.

AUTHOR'S ACKNOWLEDGMENT: Credit for valued assistance in the research conducted by the authors is given to Dr. and Mrs. E. H. Toole, Dr. H. A. Borthwick, and Dr. M. W. Parker, all of the division of fruit and vegetable crops and diseases (BPISAE); to R. H. Nelson, senior entomologist, division of control investigations, and Dr. A. C. Baker, principal entomologist (BEPQ) (Mexico City, Mexico); to Dr. Howard Reynolds, bacteriologist, division of foods and nutrition (BHNHE); to Dr. R. W. Bell, dairy manufacturing technologist (BDI), and to Frank Babers, biochemist (BEPQ), U. S. Department of Agriculture.

Sound waves are basically the expansion and compression of a medium. The wave length decreases with an increase in the frequency for any given medium. Frequencies of sound waves above 100 kilocycles are quite short in wave length. In water, for example, the acoustical wave length for 400 kilocycles per second is slightly less than four millimeters. At 1,500 kilocycles the acoustical wave length is about one millimeter.

Above the frequency of 100 kilocycles present sensing elements are not well suited for indicating the intensity output. For initial tests of the acoustical power of high-intensity generators, some approximate measurements have been made by calorimetric substitution. This method is not suited for evaluating output during continuous tests. The basic electrical energy used by the generator is an indication of the output if allowances are made for the efficiency of conversion from electrical to mechanical energy and for other losses in the generator.

Types of Generators. Three ways of producing high-intensity ultrasonic waves, which differ as to the principle utilized, are in general use. The siren type of generator produces frequencies slightly above the audible range in air.

The magnetostriction-type generators produce sound waves by the magnetization and demagnetization of a metal rod, such as nickel, to which a circular plate is usually affixed as a radiator. Because of the shortness of wavelength (0.6 in at 100 kilocycles) the physical size of the component parts limits this system to frequencies less than about 100 kilocycles. This type of generator is useful in either gases or liquids. In the upper range of the generator, however, the transmission loss in air becomes increasingly greater. Practical transmission in air then is not possible.

The piezoelectric generator produces sound waves by use of the piezoelectric effect, discovered by Pierre and Jacques Curie in 1880. This uses an X-cut quartz crystal that expands and contracts when an alternating voltage is applied to the surfaces of the crystal [2]. The vibrations so produced are at the same frequency as the alternating current. However, when the frequency of the current is equal to the natural resonant frequency of the crystal, the intensity of vibration is magnified very greatly. Langevin [3] found that the resonance could be improved by the use of steel plates as holders for the crystal. These generators made for high-intensity work are usually mounted in transformer oil, with the oil acting as a convenient method for transmitting waves as well as a cooling and insulating medium.

Both magnetostriction and piezoelectric generators operate on a fixed frequency, with the intensity varying according to the applied electrical energy. The propagation pattern of ultrasonic waves is highly directional. For example, at 300 kilo-

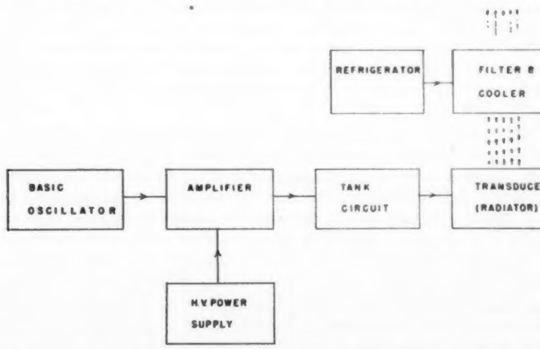


Fig. 1 Block diagram of ultrasonic system used in research at Beltsville, Md., reported in this paper

cycles, the sound is radiated in water in the form of a cone with an angle of only about 5 deg.

Technics of Use. In the commercial high-intensity piezoelectric generators, the vibrations originate in a circular quartz crystal of about 1½ in diameter, and the thickness of the desired wave length. The area which can be energized by the waves is thus determined by the diameter of the crystal.

Magnetostriction generators may have slightly larger radiators of steel; the base of the container for the material or object under test can act as resonator.

In both magnetostriction and piezoelectric generators heat is produced by the conversion of electrical oscillations to mechanical oscillations, and by the action of the sound waves. Unless this heat is harmless to the objects or materials being tested, a system of heat removal is necessary. With a high-intensity piezoelectric generator, such as used at Beltsville, a temperature increase in the oil bath of at least 2 F (degrees Fahrenheit) per minute is to be expected unless cooling is employed.

Because transformer oil is undesirable for immersion of most objects, it is common to subject the specimens or solution to vibration in a vessel, such as a test tube, flask, or metal cup, containing a more suitable liquid, for instance, water. Vessels with flat surfaces evidence a very critical relation with respect to the distance from the surface of the radiator to the base of the container. Stumpf [4] states that when this distance is a multiple of the whole wave length of the ultrasonic vibration, any reflection from the base of the container will cause partial interference. However, when the distance is an odd multiple of the wave length, some reinforcement of the waves occurs. This adjustment can result in as much as 50 per cent variation in the effects within the vessel [4].

It has been reported that round-bottomed test tubes or flasks are much less critical in placement than those with flat surfaces although the total absorbed energy may not be as great. A suggested method for modulating the frequency and thus varying the standing wave length is under development. The effects, on any test material, of electromagnetic and electrostatic fields from the high frequency of the oscillator must also be recognized.

INVESTIGATION AT BELTSVILLE

The division of farm electrification of the Bureau of Plant Industry, Soils, and Agricultural Engineering at Beltsville, Md., has a high-intensity ultrasonic generator which has been used for preliminary studies within the divisions of this bureau and in cooperation with the other bureaus of the Agricultural Research Administration. Our studies have indicated some of the practical applications of ultrasonics and the problems concerning such application.

The generator referred to is of the piezoelectric type and operates on four fixed frequencies. A block diagram of the machine is shown (Fig. 1). The oscillator or high-frequency generator is essentially a radio-frequency generator modified to match the electrical impedance of a transducer (a transducer being a device used for converting electrical energy to mechanical energy). The electrical output of the generator is transmitted to the transducer by a coaxial cable. The transducer of this generator includes a variable air condenser and a tesla coil. The transducer, crystal, and matching network are housed in a battery jar containing about 12 liters of transformer oil.

A radio-frequency ammeter and a vacuum-tube voltmeter have been added to this machine, making possible a constant indication of the radio-frequency volt-amperes in the high-frequency line to the transducer. On the top of the battery jar is a copper shield, which has in the center a copper cup of about 3 in diameter and 3 in deep. A 2-in hole in the bottom of the cup is covered by a strip of copper less than 0.002 in thick. The cup acts as container for a cooling bath. Water is used in the cup as a practical liquid for both immersion and cooling of test specimens. The radiations originating at the crystal are transmitted through the oil into the test cup containing water.

Descriptions of some of the experiments started at Beltsville follow, including also some reference to other work that by nature is of parallel interest to the discussion.

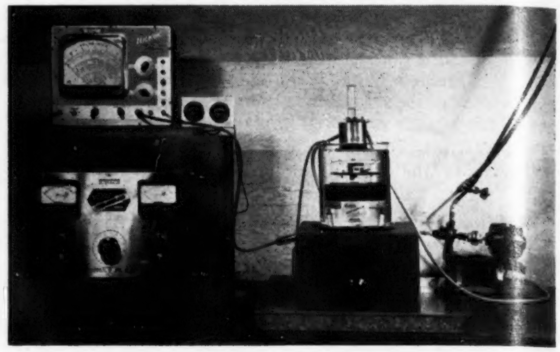


Fig. 2 Equipment setup for ultrasonic research

The stimulation of seeds and tubers first reported by Istomine and Ostrovskij [5] seemed to offer promise as a practical tool. Our tests have shown that the germination period of certain seeds and tubers may be reduced by treatment with ultrasonics. It also has been found that some seeds are killed by long exposures at high intensity with the temperature remaining nearly constant. The effects on flowering, growth, and yields have not yet been evaluated with respect to time of treatment and intensity of treatment.

The production of mutations seems to be an entirely separate effect. Wallace [6] reported on the introduction of cytogenetic variations by ultrasonic waves in root tips. Conger [7] indicated that combination sonic and X-ray treatment induced chromosomal aberrations with about 1.3 times the yield obtained by the same amount of X rays alone.

In tests at Beltsville of the biological effect on insects in cooperation with the Bureau of Entomology and Plant Quarantine, mosquito larvæ were killed within 5 sec in water at 400 kilocycles with waves of an estimated 300 w acoustical power. Limited tests at lower intensities indicated the percentage of mortality to be directly correlated with the amplitude of the waves. Within the time limits of the test the percentage of mortality did not differ significantly with length of exposure. Mosquito larvae killed by the high intensities appeared, upon examination, to be literally torn apart.

Under similar conditions the larvae of codling moth required exposures up to one minute for killing. When the larvae were imbedded in fruit, they were apparently undisturbed. Frings [8] has reported on some effect on mice and roaches with an ultrasonic siren and states that the animals were literally cooked to death by heat absorbed from the sound waves.

The Bureau of Entomology and Plant Quarantine was also interested in whether ultrasonic sterilization of citrus fruits offered a feasible means of fruit fly control. Our cooperative tests on orange juice were discouraging because they indicated that the amount of Vitamin C remaining after exposure was inversely related to the time of exposure.

The effect on bacteria is being studied by many investigators. Limited experiments with suspensions of an unidentified staphylococcus and of anaerobic bacterial spores were made to determine the effectiveness of exposure to ultrasonic energy as a means of dispersing bacterial clumps to facilitate the making of viable counts. At 400 kilocycles, considerable disintegration of staphylococcus clumps occurred in 3 to 6 min but was not complete after exposures of 30 to 60 min. Viable counts of the bacterial spore suspensions were unchanged by similar exposures.

The killing of bacteria has been reported at low ultrasonic frequencies [9] as well as at the higher frequencies. Chambers [10] in 1927 reported the possibility of sterilization and homogenization of milk by ultrasonics. For lack of suitable equipment few investigations of this process were made at the time. Our limited investigations with the Bureau of Dairy Industry indi-

cated that the size of fat globules could be reduced by ultrasonic waves.

The production of emulsions and near dispersions is of importance both in agricultural laboratories and in food processing. Olmstead [11] reported that soil dispersions could be obtained much more quickly and easily by the ultrasonic method than by either the pipette or the rubbing method.

The production of stable dispersion of DDT in water has been reported under development. Our first tests in cooperation with the Bureau of Entomology and Plant Quarantine, revealed that the particles of DDT could be reduced by ultrasonic vibration to smaller size than was heretofore possible by the usual processes.

SUMMARY

As indicated above, the use of ultrasonic energy in agriculture is yet largely unexplored and offers wide opportunities for research. The persistent appearance of so many reports on the agricultural uses of ultrasonic energy indicates the need for additional studies.

Among other things we should evaluate the following:

1 Frequencies and/or combination of frequencies
2 Intensity of wave propagation
3 Radiofrequency electromagnetic and electrostatic field effects
4 Heat developed
5 Length of exposures
6 Technic of application of ultrasonics

The fields in agriculture for immediate investigation should include:

1 Biological effect on plant and animal materials
2 Bacterial control
3 Sterilization or pasteurization of milk and other food products
4 Homogenization of milk
5 Emulsification and near dispersion in liquids
6 Coagulation of particles suspended in fluids
7 Control of insects
8 Control of diseases
9 Production of mutations in grains, bulbs, etc.

LITERATURE CITED

1 Wood, R. A. and Loomis, A. L. Physical and Biological Effects of High-Frequency Sound Waves of Great Intensity, Phys. Rev. (II) 29: 373, 1927, and the Physical and Biological Effects of High-frequency Sound Waves of Great Intensity, Phil. Mag. (VII) 4: 417, 1927.

2 Cady, W. G. Piezo-Electricity, McGraw-Hill Book Co., New York, 1946).

3 Langevin, M. P. British Patent Nbr. 145691 (1920).

4 Strmpf, P. K. Green, D. E. and Smith, F. W. Jr., Ultrasonic Disintegration as a Method of Extracting Bacterial Enzymes. J. Bact. 51(4), April, 1946.

5 Istomina, O., and Ostrovskij, E. The Effect of Ultrasonic Vibrations on Plant Development. Compt. Rend. (Doklady) Acad. Sci. USRR, 2(4): 155-160, 1936.

6 Wallace, R. H., Bushness, R. J., and Newxomer, E. H. The Induction of Cytogenetic Variations by Ultrasonic Waves. Science, 107: 577-578, May, 1948.

7 Conger, A. D. The Cytogenetic Effect of Sonic Energy Applied Simultaneously with X Rays. Proc. Nat. Acad. Sci., 34(10), October, 1948.

8 Fring, H. G. Pest Control with Sound Waves, Pests, April, 1948.

9 Shropshire, R. F. Turbidimetric Evaluation of Bacterial Disruption by Sonic Energy, J. of Bacteriology 53(6): 685-693, June, 1947.

10 Chambers, L. A., and Gaines, N. Further Study of Effects on Intense Audio-Frequency Sound. Phys. Rev. (II) 39, 862 (1932).

11 Olmstead, L. B. Dispersion of Soil by a Supersonic Method. Jour. Agr. Research, vol. 42(12), June, 1931.

SELECTED REFERENCES ON ULTRASONICS

L. Bergmann, Ultrasonics and their scientific and technical applications, translated from the German (Wiley, 1946). A textbook with references through 1938.

R. W. Wood, Supersonics (Colvar Lectures), Brown University (1937). Discusses mainly waves of large amplitude.

Walter G. Cady, Piezo-Electricity (McGraw-Hill Book Company, New York, 1946). A textbook in crystals having extensive bibliography in ultrasonics at the end of chapter 28 and at the end of the book.

J. C. Hubbard, Ultrasonics — A Survey. Am. J. of Physics, vol 8(4), August, 1940. Discussion of physics of ultrasonics with references.

P. A. Ark and Willet Perry. Application of High-Frequency Electrostatic Fields in Agriculture. Q. Rev. Biol., vol. 15(2), June, 1940. Contains excellent bibliography.

Journal of the Acoustical Society of America. A current periodical devoting a part of each publication to ultrasonics.

Battle of the Steppes

By Otto Schnellbach
MEMBER A.S.A.E.

EDITOR'S NOTE: This article was specially prepared for AGRICULTURAL ENGINEERING, and was translated from the German by R. B. Gray, U.S.D.A. Dr. Ing. Otto Schnellbach is agricultural engineer in the department for supervision of agricultural engineering research in the American occupation zone of Germany.

THE Russian daily papers for weeks published full page news of huge plans of the central government and party authority concerning the installation of wooded shelter belts and the introduction of grassland farming.

Of the abundance of plans and provisions of the laws and regulations we give here only a brief summary of the whole problem:

The steps for combatting the steppes are to be carried out as rapidly as possible in the Volga region of the North Caucasus and in the central heavy soil region. Shelter belts on both banks of the Volga from Saratow to Astrachen are to be provided by 1965 with a width of 100 meters and length of 900 kilometers. In the direction of Pensa-Kamensk to the north of the Donezon on the watershed of the Choper and Medwediza and of the Kalitwa and the Beresowa, three-part shelter belts are to be planted, each of which is to be between 60 and 300 meters wide with a total length of more than 600-kilometers. In the direction of Kamyschin-Stalingrad in the Volga and Ilowla watershed will also be planted a three-part continuous forest belt 170 kilometers long. Between Wischnewaja and the Caspian Sea a four-part belt 570 kilometers long is to be provided. On both banks of the Ural River are to be laid out three wooded strips 60 meters wide, with an interval of from 200 to 300 meters between and a length of over 1000 kilometers. In addition there is to be a 920-kilometer strip between Woronjesch and Rostow on the Don Neuwald and another 500 kilometers long on the upper Don between the city of Bjelgorod and the river.

What is the aim of this shelter belt? The Russians have divided the entire steppes region into large rectangular shelter belts 30 to 300 meters wide. These forest belts protect the fields lying in between from the sharp winds and their drying action. Furthermore, they bind the quicksand stretches, for between the oaks, birches, ashes, poplars, and maple trees are planted rose hedges, acacias (locusts), and other shrubs.

Planted with trees were river banks, all the borders of pits, ponds, the steep slopes of ravines, and all barren spots.

The first-named large and wide multiple forest belts form four scattered wooded curtains in a northerly and southerly direction which protect the entire threatened district from the devastating winds which come from the Asiatic deserts. The other wooded strips which pass through the entire country are divided into rectangles which guard against the wind and keep the small amount of moisture in the soil and compact the sand dunes.

As a second precaution, the introduction of grassland farming should be mentioned; thus a crop rotation, which besides black fallow, provides high yielding perennial types of grass forage. It has been recognized up till now that the usual stubble fallow dries out the soil until it becomes stonehard and cracks, or falls apart in fine dust particles so that the wind carries it away. Opportune stubble cropping in the fall prevents this danger and several years of grass farming firms the all-too-light sandy soil of the steppes.

As a third measure is a new form of agricultural technique in which the soil is plowed deeply with a double-decker plow which deeply aerates the soil without bringing dead soil to the top. Then should follow naturally a good fertilizing, generous harrowing, and other expedients which loosen the soil surface and prevent moisture evaporation. Thereafter it is given a systematic watering and sprinkling from streams, canals, and ponds.

We are, however, less interested in the dreams of the future than in a statement of what actually has been accomplished in this field.

Up to 1947 there were 323 hectare wooded shelter strips layed out. In 1947 even another 146 hectares were added and in 1948 another 214 hectares. This is all in the vicinity of Stalingrad where the first experiments with wooded strips and grass farming were started in 1938. Thirty-eight model organizations with machine and tractor stations were established. These have helped the collective farms in the performance of the new tasks. The system gave the first evidence of advantage in the drought year 1946, where in the Stalingrad sector not a drop of rain fell from spring till summer, and temperatures up to 40 degrees (probably C) were measured. The *(Continued on page 243)*

An Air Purification Unit for Apple Storages

By H. E. Gray and R. M. Smock
MEMBER A.S.A.E.

FOR many years the only considerations given attention in the storage of apples were the control of temperature and relative humidity. As a result of considerable work by numerous investigators [1,2,3,4,5,6]* other aspects of storage atmosphere have recently been studied. These are the presence of ethylene, scald gases, and odors.

Apples give off ethylene gas as they ripen. The presence of ethylene will stimulate the ripening of other apples in the room under certain situations[3]. Since the presence of some ripe apples in a storage room is unavoidable, the question arises as to the possibility of removing this gas by air purification[4,6].

Ripening apples give off gases other than ethylene. Certain of these produce a disease known as apple scald and hence is derived the term scald gases[1,5]. Preliminary work has been done on removal of some of these scald gases by air purification.

Odors in an apple storage may be given off by the apples, by the storage containers, by the materials used in building construction, by the machinery, or by other causes. In most storages there is no problem of contamination of the fruit by odors, but in others the problem does exist. Work on the study of elimination of odors by air purification has already been reported[2].

One method of removing ripening and scald gases from storage air that has been found successful is to pass it through activated coconut-shell carbon (charcoal)[6]. At the same time most of the undesirable odors are removed.

As a result of these findings, the question arose as to the design of a unit which would pass a sufficient amount of the storage air through activated carbon. The unit had to be adaptable to present design of refrigerated storages and still be within the financial reach of the average storage operator. The rest of this paper deals with such a unit which was designed and constructed at Cornell University during the summer of 1948. This unit was operated in a commercial storage in the Hudson Valley of New York during the 1948-49 storage season. Results of operation for this storage season will be included.

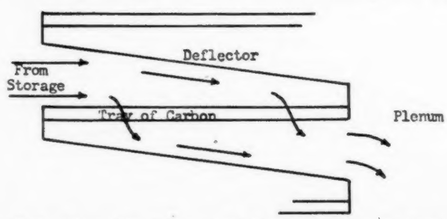


Fig. 1 Path of air through trays of the Cornell air purification unit

It has been determined that for every 1000-bu capacity of apple storage 6 lb of carbon should be used and air passed through this at the rate of 100 cfm[6].

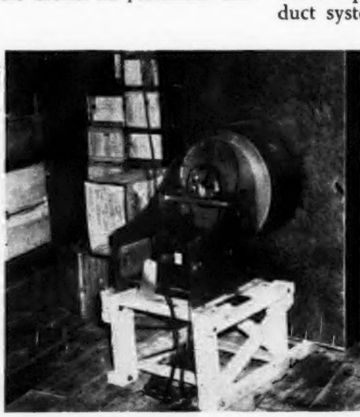
In order to obtain sufficient exposed carbon surface, the carbon was placed in trays one inch deep. The trays were constructed of 1x1-in wood frames with copper window screen to support the carbon and 1-in hardware cloth supporting the screen. It was found that two additional ½x1-in strips across the tray were required to prevent sagging. They trays were built 30½ in square, inside dimensions, so that each tray had a net area of carbon surface of 900 sq in exposed. Seven trays were placed one on top of the other, spaced 6 in apart. The openings at the back allowed air to come in contact with the surface of the trays, and openings at the front allowed air coming through the trays to pass into a plenum chamber at the front. Air deflectors were installed above and below the trays to guide the path of the air. The path of air through one tray is shown diagrammatically in Fig. 1.

The entire unit was supported by a framework of 2x2-in lumber, covered with tempered masonite. The plenum chamber was 15 in wide from the front openings and covered the entire width and height of trays. A centrifugal fan was mounted at the front. A hole cut in the middle of the front sheet of masonite accommodated the fan intake. The fan mounting is shown in Fig. 2.

It was determined theoretically that a one-inch carbon layer would offer a resistance of 0.35 in static pressure to air passing through at the rate of 40 fpm. Consequently, the fan was chosen to deliver 1832 cfm (manufacturer's rating) under ⅜ in static head at 742 rpm. Actual delivery during the storage period as determined with an anemometer averaged approximately 1800 cfm. The area of carbon tray surface was 43.8 sq ft so the actual air velocity through the carbon was 41.1 fpm.

Carbon was placed in the trays, leveled off, and vibrated by hand; then more was added until the surface of the carbon was level with the frame. Air movement through each tray was balanced by adding or taking away carbon. In this way a total of 102 lb of carbon was placed in the unit. According to the recommended amount of carbon[6] this unit was sufficient for a storage capacity of 17,000 bu of apples.

The storage chosen for the commercial test was a 42,000-bu storage divided equally into two rooms. Both rooms were held at 32 F and the relative humidity ranged between 80 and 85 per cent. Both rooms were equipped with brine spray diffusers and similar duct systems for air distribution throughout the rooms. In the treated room, the purification unit was set on the floor near the diffuser. It was so oriented that the intake took return air coming down the aisle and discharged it directly toward the intake of the diffuser. In this way air having the highest concentration of impurities was taken in and the purified air was discharged to the storage through the duct system. This gave assurance of a good distribution of



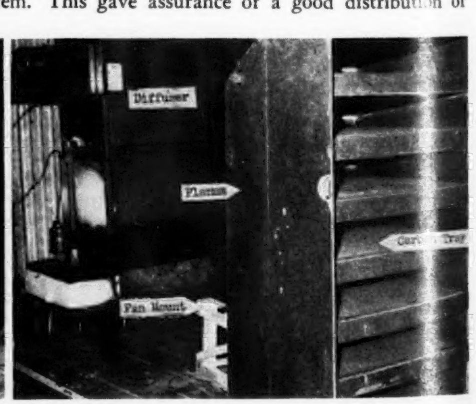


Fig. 2 (*Left*) Fan mounting for the Cornell carbon-tray air purification unit • Fig. 3 (*Right*) Location of the purification unit in a commercial storage. Trays of activated carbon may be seen at the right

This paper was prepared expressly for AGRICULTURAL ENGINEERING.

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* Superscript numbers refer to appended references.

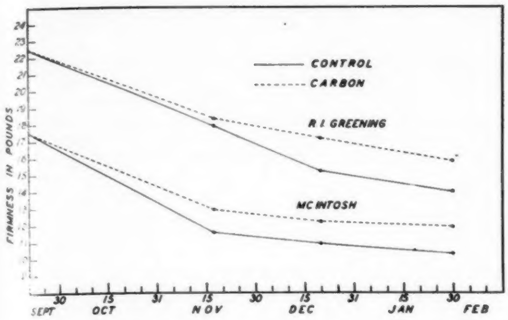

Fig. 4 Loss in fruit firmness of Rhode Island Greening and McIntosh apples in untreated (control) storage room and room with air purification (carbon)

purified air. The location of the unit in the storage is shown in Fig. 3.

The test apples (Rhode Island Greenings and McIntosh) were harvested at the Cornell University orchards on September 14, 1948, and placed in the test storage rooms the following day. A Magness-Taylor pressure tester was used to determine fruit firmness before, during, and after storage. One lot of Greening apples in the control room was mixed with oiled paper at the rate of ½ lb per box. This is the conventional method for reducing scald. All apples were removed from the storages on January 29, 1949, and examined for slight, severe, and total scald. Since scald may not be obvious upon removal of apples from storage, even though it is caused in storage, the apples were held at room temperature for 3 days and re-examined.

RESULTS

The results of the firmness tests are shown graphically in Fig. 4. The over-all results are shown in Table 1.

TABLE 1. EFFECT OF STORAGE AIR PURIFICATION WITH TRAY UNIT ON RHODE ISLAND GREENING AND McINTOSH APPLES

Treatment	Firmness* after storage, lb.	Days storage life added	Percent Scald† after 3 days at room temperature		
			Slight	Severe	Total
		R. I. Greening			
Control	13.9	—	36.40	4.60	41.0
Oiled paper	14.2	5	8.49	.77	9.26
Air purified	15.6	28	12.60	0.0	12.60
		McIntosh			
Control	10.2	—	0.0	0.0	0.0
Air purified	11.9	31	0.0	0.0	0.0

* Original firmness of R. I. Greenings, 22.5 lb. Original firmness of McIntosh, 17.5 lb.

† No scald was noted on any apples when taken from storage.

McIntosh. The air purification treatment resulted in fruit that was 1.7 lb firmer at the end of the storage period than apples with no treatment. This represents an increase of almost one month in the storage life as a result of treatment.

Rhode Island Greening. Oiled paper resulted in apples 0.3 lb firmer than the controls, with an added storage life of 5 days. This difference is not significant. Air purification resulted in apples 1.7 lb firmer with an added storage life of 28 days.

Both oiled paper and air purification reduced scald materially, but did not entirely control it. Practically all of the scald in these two lots was very slight in degree on each affected apple.

SUMMARY

The Cornell carbon tray air purification unit was effective in lengthening the storage life of McIntosh and Rhode Island Greenings about one month. It was also effective in reducing scald by removing scald gases, although no more effective than oiled paper packing. Reducing scald by this method is cheaper than packing the apples in oiled paper.

The unit has the following disadvantages:

1 It is bulky.

2 Slight differences in thickness or packing of activated carbon in trays result in uneven air movement through the tray. Hence, air flows should be balanced after introduction of the carbon.

3 Carbon used for air purification must be reactivated peridodically. In this home-built unit, the trays are not removable, so the carbon removal is not a desirable job. Reactivation is necessary after each season's use. If need arises, removable trays could be designed.

However, the unit can be built at home by the storage operator with his own labor. Hence an air purification unit can be obtained that will increase storage life of apples, reduce scald, and still be economical to construct.

REFERENCES

1 Brooks, Charles; Cooley, J. S.; and Fisher, D. F. Nature and Control of Apple Scald, J. Agr. Research 18:211-240, 1919.

2 Gross, C. F. and Smock, R. M.; Studies on odor elimination in apple storage. Refrig. Eng. 50: 535-540, 1945.

3 Smock, R. M. The influence of stored apples on the ripening of other apples stored with them. Cornell Univ. Agr. Exp. Sta. Bul. 799, 1943.

4 ...., ... The elimination from atmosphere of ethylene evolved by apples, Amer. Soc. Hort. Sci., Proc. 44: 134-140, 1940.

5 ...., ... and Southwick, F. W., Studies on storage scald of apples, Cornell Univ. Agr. Exp. Sta. Bul. 813, 1945.

6 ...., ... and ...., ...; Air Purification in the apple storage, Cornell Univ. Agr. Exp. Sta. Bul. 843, 1948.

Battle of The Steppes

(Continued from page 241)

earth showed fissures, the soil was scorched, and over the bare steppes lay a gray fog of glowing dust.

Under the new system the grain production reached an average of 20-25 dz/ha. Also in particularly dry years the yield of winter wheat was 16.5, winter rye 15, summer wheat 10.6, oats 15.8, and sunflowers 21.2 dz/ha.

The well-known Sowchose-Gigant (state farm) at Rostow on the Don had in the meantime layed out 600 shelter strips and had a yield of winter wheat of more than 25 dz/ha. These figures are noteworthy, for in the particularly arid regions little grows, and in dry years nothing at all.

A kolchose (collective farm) in the district of Nova Annensk was changed over to a ten-field management and played a large role in the culture of field grass and meadow feed. Fourteen kolchosen of this district had long standing yields and even before there was indicated remarkable results. On eleven of these kolchosen the change-over from several years of grass production into the former rotation brought an average yield for the years, 1944-47, of 13.8 dz/ha of summer wheat while in other fields without grass strips in between only 12.13 dz/ha was harvested.

Thus Russia has introduced new measures in the fight against the steppes—a fight which in such a dangerous country requires a tremendous effort to carry through.

Efficient Use of Irrigation Water

LOW labor cost with sprinkler irrigation may be more important than the whole power bill. Where there is a choice of methods on medium-textured soil of good topography, the choice between surface or sprinkler irrigation may be determined by the total annual cost over a long period, say, 20 years. Low gross crop value per acre may not support the cost of sprinklers, while high cost of water for use in small amounts for supplemental irrigation may justify the relatively high cost per acre-inch with sprinkler irrigation of intensive crops. Each farm must be considered and the choice made according to the particular conditions.—From a paper by W. L. Powers, applying particularly to the Willamette Valley, published in "The Reclamation Era," March, 1949.

RESEARCH NOTES

A.S.A.E. members and friends are invited to supply, for publication under this heading, brief news notes and reports on research activities of special agricultural engineering interest, whether of federal or state agencies or of manufacturing and service organizations. This may include announcements of new projects, concise progress reports giving new and timely data, etc. Address: Editor, AGRICULTURAL ENGINEERING, St. Joseph, Mich.

USDA Notes on Electric Heat for Beehives, Frozen-Food Locker Plants, and Grain Drying and Storage

BEEKEEPERS in northern climates suffer heavy losses from winter killing of their bees. With some means of helping the colonies keep the hives warm, they could cut their losses. More of their colonies would overwinter successfully and get an early start on raising spring brood. Strong colonies of healthy young bees early in the season mean greater honey production and more thorough pollination of fruit and legume blossoms.

Engineers of the USDA Farm Electrification Division are cooperating with the Division of Bee Culture (BEPQ) in a project located at Madison, Wis., on heating hives electrically. They are testing various installations to determine the best size and shape of heater and the proper location in relation to bee movements within the hive in cold weather. Another phase of their investigations involves finding out what type of thermostatic control works best for both winter and spring heating.

Extra warmth may prove to be as important a help to bee colonies during cold snaps in spring as in winter. Thermocouple readings in preliminary studies at Madison show that the bee nurses maintain a temperature of about 93 F in the vicinity of brood. Heated hives may also prove helpful to queen breeders in southern states, where spells of cold weather frequently interfere with raising queen bees for early spring shipment.

This project, begun last winter, was interrupted by a fire which destroyed the laboratory. It is now getting under way again with Charles D. Owens as the USDA agricultural engineer in charge. Owens, recently appointed to the Farm Electrification Division, has been a graduate assistant in the agricultural engineering department at the University of Wisconsin, where he has received BS degrees in agriculture and mechanical engineering and an MS in agricultural engineering.

Frozen-Food Locker Plants in Georgia. W. M. Hurst of the Division of Mechanical Processing of Farm Products is joint author with H. D. White and W. E. Garner, agricultural engineers at the University of Georgia, of a report entitled "Frozen-Food Locker Plants in Georgia", just published by the University. Part of a broad research program dealing with rural industries and services, this preliminary publication is a survey of operations, layout, and equipment. The bulletin's first sentence indicates the importance of this work: "The number of frozen-food locker plants in Georgia increased from 8 in 1940 to 150 in 1947."

An engineering study of 21 plants in the state was made in 1947. Since the work of planning, locating, and constructing many of these plants was done under pressure of war emergency, some are too small and others too large for the communities they serve. Although the plants have been in operation only a few years, enough time has elapsed, the engineers say, for a pattern to emerge showing desirable features in plant layout and equipment affecting operations. For the guidance of present and prospective plant managers, the bulletin offers suggestions on location, design, refrigeration equipment, processing equipment, on handling locker produce, and on reducing power and labor costs.

Grain Drying and Storage. The Commodity Credit Corporation has asked BPISAE to determine the kind of information needed in connection with grain drying and storage problems and assemble the available information for use during the coming summer and fall, when heavy storage requirements are expected. A meeting was held at Ames, Iowa, on March 10, 11, and 12, attended by representatives of the Iowa, Illinois, and Indiana Agricultural Experiment Stations, the Grain Branch of PMA, and the USDA Division of Farm Buildings and Rural Housing. The group prepared a list of 30 farm storage buildings for which plans will be needed. These buildings will provide for temporary or permanent storage of ear corn, shelled corn, and small grain.

The list includes designs for buildings to be prefabricated either at factories or at country lumber yards. Some of the structures will provide for mechanical drying of ear corn or small grain. The work of revising available plans and developing new designs will be divided among the three agricultural experiment stations and the Division of Farm Buildings and Rural Housing.

Publications issued in connection with the original ever-normal granary program will be revised. They will give the general requirements for grain storage, information useful to those planning to build or remodel storage structures, and instruction on methods of insect control.

BPISAE Annual Report. Off the press in January, the 1948 report of Dr. Robert M. Salter, chief, BPISAE, features an introductory round-up of production techniques developed through research and now in practical use on farms. Pointing out that new techniques represent the pay-off on research that has been carried on over many years, Dr. Salter gives credit to the many individual scientists whose enterprise has made these new tools available to farmers. He adds that the cooperative approach to research problems has played an especially important part in the achievements of the Bureau.

Among outstanding research findings of the Bureau's 18 divisions covered in the 90-page report are many in the field of agricultural engineering, including crop conditioning, livestock housing, effects of radiant energy, farm uses of electricity, development of machinery and equipment to keep pace with advanced research and farming techniques, and mechanical processing in large and small scale operations.

Pennsylvania Notes on Plow Beams and Shares, Cushion Hitches, and Corn Production

A. W. Clyde spent a sabbatical leave last summer in the engineering departments of Allis-Chalmers Mfg. Co., LaCrosse, Wis., and the John Deere Waterloo Tractor Works, Waterloo, Iowa. At Allis-Chalmers, the main jobs were to study the strength and deflection characteristics of various plow beams and plow shares, also to test different types of cushion hitches.

In the plow beam tests, an attempt was made to load the beams by a hydraulic jack in the most severe manner that is likely to occur in the field. This requires that a twisting as well as a bending load be imposed, since beams damaged in service are commonly both twisted and bent. On multibeam plows the effect of such loading is difficult if not impossible to calculate because the beam being loaded gets assistance from the adjacent beam or beams. For this reason, actual loading tests seem necessary to compare various constructions. When beams were being tested, the share and frog were replaced by a strong fixture, the load being applied at a location corresponding to the point of the share. This was to avoid being limited by the strength of the share or frog.

A promising type of cushion hitch made and tested at LaCrosse was a hydraulic one with a pressure relief valve for regulating the resistance. In this style a holding device carries the normal pull. It releases when the plow hits an obstruction, and the pull then is taken on the hydraulic cylinder. Ten inches of movement is provided in the latter. If the relief valve is set to give a resistance of 4500 to 5000 lb, this provides a large capacity 45,000 in-lb or more, to absorb the kinetic energy of the tractor, its drawbar pull, and additional force due to going down a slope. In a spring type of cushion hitch, this amount of capacity would require such a large weight in springs that most people would consider it impracticable.

At the John Deere Waterloo Tractor Works, Mr. Clyde worked mostly on the dynamics of a tractor tipping over backward. This involves the inertia of the frame against rotation around the rear axle and the additional torque which may be contributed by the flywheel and attached parts when the engine speed is reduced. One of the most dangerous situations for a rear tipping accident occurs when the rear wheels get stuck in a ditch and the operator disconnects the load. If he then uses "full speed ahead" in low gear and the drivewheels get sufficient traction, there is danger of an accident. Another dangerous situation is produced if the drivewheels are in a ditch and the operator attempts to pull a load attached at an unusually high point on the tractor. This may be done by putting a chain over the rear axle, or as has actually ocurred, by attaching a chain to the seat post. Wayne H. Worthington and his associates at Waterloo have done extensive work for a number of years on tractor stability against both rear and side-tipping. Mr. Worthington gave a comprehensive report on this subject at the ASAE Winter Meeting at Chicago in December, the second part of which will be found elsewhere in this issue.

Three years ago the agricultural engineers started working with other departments on a program of better corn production. R. E. Patterson and A. W. Clyde have had cultivation plots going for three years and Mr. Patterson is working on equipment for chemical weed control.

Practically all corn in the Northeast is drilled, hence control of weeds in the row has often been poor. Considerable hoeing was done years ago but few farmers will consider that now. Another characteristic of this locality is the common use of narrow cultivator shovels, 2 to 2½ in wide. No information could be found as to their merits in weed control as compared with sweeps, though it is suspected that corn is often damaged by running narrow shovels too deep.

Four replications of the main plots are used, each being split into subplots with thick and thin planting. Narrow shovels and sweeps are compared, on each rate of planting, and various numbers of cultivations are compared. Last year a treatment with cultivation 4 to 5 in deep was added. Unfortunately the stand of corn last year was irregular and the results were quite variable. This year it is planned to include certain combinations of chemical treatment with cultivation.

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Committee on Fertilizer Application — Glenn A. Cumings (chairman), C. J. Allen, G. B. Nutt; G. W. Giles, H. P. Smith, W. L. Zink, J. P. Fairbank, R. H. Wileman, C. H. White, C. E. Guelle, B. C. Reynolds, C. M. Hansen, H. V. Hansen, H. T. Barr, L. W. Hurlbut

Committee on Crop Residues — I. D. Mayer (chairman), A. L. Young, E. A. Silver, W. H. Lowry, F. D. Jones, F. N. G. Kranick, F. C. Fenton, R. B. Gray, E. C. Lathrop, Hobart Beresford

Committees — Rural Electric Division

Ben D. Moses, chairman of division
C. P. Wagner, vice-chairman
J. B. Stere, junior past-chairman

Committee on Hay Harvesting and Storage (Joint with Power and Machinery and Farm Structures Divisions — see listing under committees of Power and Machinery Division)

Committees — Farm Structures Division

J. F. Schaffhausen, chairman of division
W. V. Hukill, vice-chairman
Henry Giese, junior past-chairman

Committee on Hay Harvesting and Storage (Joint with Power and Machinery and Rural Electric Divisions — see listing under committees of Power and Machinery Division)

Committees — Soil and Water Division

Aldert Molenaar, chairman of division
R. B. Hickok, vice-chairman
R. C. Hay, junior past-chairman

Committee on Drainage — J. G. Sutton (general chairman)

Subcommittee on Depth and Spacing of Tile Drains — R. K. Frevert (chairman), K. H. Beauchamp, T. W. Edminster, E. H. Kidder, H. N. Luebcke, W. F. Lytle, P. W. Manson, W. W. Donnan (advisory)

Subcommittee on State Drainage Laws — I. D. Mayer (chairman), K. H. Beauchamp, A. Carnes, R. W. Carpenter, J. R. Haswell, O. W. Israelsen, P. W. Manson, Virgil Overholt, E. G. Welch

Subcommittee on Drainage of Irrigated Lands — M. R. Lewis (chairman), W. W. Donnan (advisory), C. R. Maierhofer, Aldert Molenaar

Committee on Irrigation — M. R. Lewis (general chairman)

Subcommittee on Sprinkler Irrigation — A. W. McCulloch, (chairman), W. W. Hinz, F. N. Johnson, Aldert Molenaar, R. M. Morgan, F. W. Peikert, Crawford Reid, L. R. Swarner

Committee on Reservoirs and Ponds — J. L. McKitrick (chairman), H. D. Ayers, C. G. Burress, J. L. Carreker, M. W. Clark, J. I. Davis, Sr., W. H. Dickerson, Jr., Virgil Overholt, C. V. Phagan

Committees — College Division

A. W. Farrall, chairman of division
Roy Bainer, vice-chairman
A. J. Schwantes, junior past-chairman

Committee on Curriculums — O. C. French (chairman), Hobart Beresford, F. R. Jones, L. W. Hurlbut, E. W. Schroeder, F. W. Peikert, Geo. B. Nutt, H. E. Pinches

Committee on Agricultural Teacher Training — R. H. Driftmier (chairman), C. F. Albrecht, D. C. Sprague, V. J. Morford, M. M. Jones, A. H. Hollenberg

Advisory Group — H. B. Swanson (chairman), H. M. Hamlin, J. K. Coggin, S. S. Sutherland, J. R. Cullison

Committee on Teaching Methods — C. W. Smith (chairman), J. P. Fairbank, J. W. Martin, R. K. Frevert, D. C. Sprague, Andrew Hustrulid, K. H. Hinchcliff

Committee on Industry Requirements — C. E. Frudden (chairman), G. A. Rietz, W. R. Peterson, E. L. Barger, H. J. Gallagher, E. D. Anderson, J. D. Long

Committee on Graduate Instruction — F. W. Peikert (chairman), F. A. Brooks, E. G. McKibben, O. C. French, H. J. Barre, Henry Giese

Committee on Accrediting — H. B. Walker (chairman), A. W. Turner, G. A. Rietz, H. J. Barre

Committee on Course Content — L. W. Hurlbut (chairman), E. W. Lehmann, R. D. Barden, J. W. Martin, J. B. Rodgers, L. L. Sammet

Personals of A.S.A.E. Members

Ned J. Bond, Jr. has resigned as associate in agricultural engineering research at the Louisiana Agricultural Experiment Station, to accept a position as engineer in the design and supervision of grain drier production for Hawthorne, Inc., at Welch, Louisiana.

Thomas E. C. Chang, recently a student in agricultural engineering at the University of Minnesota, is now engaged as agricultural engineer in charge of testing work in the design, development, and research department, farm tool shop administration, Board of Trustees for Rehabilitation Affairs, Shanghai, China.

E. C. Easter, first in the position of chief agricultural engineer and more recently manager of the rural and towns division of Alabama Power Company, has been promoted to the position of sales manager of the company effective April 15.

Harold L. Geiger has resigned as assistant chief engineer, Frazer Farm Equipment Division, Graham-Paige Motors Corp., to accept employment as project engineer in research and development for Dearborn Motors Corp., of Detroit.

Joseph D. Hammon has been transferred from the position of regional agriculturist of the Bureau of Reclamation, USDI, at Sacramento, Calif., to the Institute of Inter-American Affairs, under the U. S. Department of State, for one year and is assigned to Paraguay. His mission is to organize and execute a land and soil classification survey of the country and to interpret the findings into land management and agricultural possibilities in that country.

David H. Harker, formerly chief engineer, Indiana Flood Control and Water Resources Commission, is now employed as secretary-engineer of the Indiana Drainage Association an organization of county associations whose members are farmers, with headquarters at Centerton, Ind. The purpose of the organization is to improve drainage maintenance by legislation and education. The Association now has 18 county organizations associated with it, with others in process of organization.

C. H. Jefferson, until recently employed as engineer of the Vermiculite Institute, is now managing a large private farming operation at Rosati, Mo.

W. J. Liddell, recently resigned as agricultural engineer, U. S. Soil Conservation Service, to accept employment as sales engineer for the Sunset Engineering Co., Riverdale, N. J., distributors of portable aluminum sprinkler irrigation equipment. His territory will be the southeastern states and he will make his headquarters at Athens, Ga.

Lloyd W. Lundin, recently employed as structural engineer by the Bureau of Reclamation, USDI, has been transferred to the Soil Conservation Service, USDA, with the title of agricultural engineer, and will be engaged in the design and construction of tile and open ditch drainage systems and soil and water conservation structures.

Lyle G. Reeser, has been advanced by Caterpillar Tractor Co. to the position of field engineer in the export department.

Douglas W. Rhett, a recent graduate in agricultural engineering of the Virginia Polytechnic Institute, is now employed as a mortgage loan inspector and is engaged in the appraisal of farm lands and residences for the Richmond, Va., office of the Prudential Insurance Co. of America.

G. Sutherland, until recently a graduate assistant in agricultural engineering, University of Wisconsin, is now employed in design work in the experimental department of the John Deere Ottumwa Works of Deere & Co., Ottumwa, Iowa.

Ray J. Winger, Jr., a recent graduate in agricultural engineering of the University of California, now holds the position of engineer and head of the engineering reports section, U. S. Bureau of Reclamation, Huron, S. D.

Frank L. Yohe recently resigned as development engineer for Electric Wheel Co., to accept the position of chief research test engineer for Dearborn Motors, Corp., Detroit.

NEWS SECTION

Barr New Chairman of Southwest Section

HAROLD T. BARR, head of agricultural engineering research at the Louisiana Agricultural Experiment Station, was elected the new chairman of the Southwest Section of the American Society of Agricultural Engineers, at its meeting held April 15 and 16 at Texarkana, succeeding R. H. S. Henderson, assistant manager, Dallas branch, Allis-Chalmers Mfg. Co.

Ross R. Mauney, agricultural engineer, Arkansas Power and Light Co., was elected vice-chairman, and E. W. Schroeder, head, agricultural engineering department, Oklahoma A. & M. College, was elected secretary-treasurer.

The total registered attendance at the meeting reached the one hundred mark, which included thirty students enrolled in agricultural engineering curriculums in three land-grant schools in the section area, all members of organized A.S.A.E. student branches. The student branch at Louisiana State University was represented by sixteen members, the student branch at the A. & M. College of Texas by eight members, and the student branch at Oklahoma A. & M. College by six members.

A very interesting program was presented, and the meeting was closed with a business session, the major item of which was to reach a decision on the place to which the Section would invite the parent society to hold its 1951 annual meeting. New Orleans, Oklahoma City, and Houston were the three places under consideration, with the decision by a vote of the members present going to Houston. In accord with this decision, the section officers will extend an invitation to the parent society through the Council to hold the 1951 ASAE annual meeting at Houston.

Iowa-Illinois Section of ASAE Organized

NEARLY one hundred members and friends of the American Society of Agricultural Engineers in Iowa and Illinois met at the Le Claire Hotel in Moline on April 9 to effect formal organization of what will be known as the "Iowa-Illinois Section" of ASAE. At a preliminary meeting of the group held on February 18, it was voted to call the new section the Quad-Cities Section, but at the meeting on April 9 it was proposed to include more territory in the section than was originally considered, and it was the apparently unanimous sentiment of the group that it should be called the "Iowa-Illinois Section."

The first officers of the new Section, elected on April 9, includes Chairman, Robert H. Meier, engineering department, John Deere Harvester Works; Vice-Chairman, George M. Eveleth, chief engineer, Rock Island Works, J. I. Case Co., and Robert R. Roth, engineering department, Moline Works, Minneapolis-Moline Co., and Secretary-Treasurer, Richard K. McConkey, district manager, Timken Roller Bearing Co.

The April 9th meeting of the new section opened with a business session which included adoption of by-laws to govern the section and the election of the above-named officers.

Following the business session the group listened with a great deal of interest to a panel discussion on the subject, "How The Iowa-Illinois Section May Best Serve Engineers and Industry." The panel speakers included George M. Eveleth, chief engineer, Rock Island Works, J. I. Case Co.; William E. Knapp, chief engineer, Moline Works, Minneapolis-Moline Co.; Arthur H. Keller, chief engineer, East Moline Works, International Harvester Co.; Carl Widseth, manager, steel building and equipment division, Miller -Piehl, Inc., and D. C. Heitshu, chief engineer, John Deere Harvester Works.

Following the luncheon the group listened with a great deal of interest to an inspiring address by Leonard J. Fletcher, director of training and equipment division, Miller-Piehl, Inc., and D. C. Heitshu, Fletcher's address was "What Do You Think?" in which he threw out a challenge to the group, both as agricultural engineers and citizens, with respect to the type of thinking they do and its relation to the future progress and stability of our country.

A.S.A.E. Meetings Calendar

May 12 — CHICAGO SECTION, Toffenetti's Restaurant, 65 W. Monroe, Chicago (Dinner meeting, 6 p.m.)

May 13 — MINNESOTA SECTION, Curtis Hotel, Minneapolis

May 13 and 14 — PENNSYLVANIA SECTION, Agricultural Engineering Bldg., Pennsylvania State College, State College

May 20 to 22 — TENNESSEE SECTION, Smoky Mountain Lodge, near Knoxville

June 20 to 23 — ANNUAL MEETING, Michigan State College, East Lansing

September 7 to 9 — NORTH ATLANTIC SECTION, Pennsylvania State College, State College

October 6 to 8 — PACIFIC NORTHWEST SECTION, Harrison Hot Springs Hotel, Harrison Hot Springs, B. C.

December 19 to 21 — WINTER MEETING, Stevens Hotel, Chicago, Ill.

Student ASAE Exhibit

A MODEL farm constructed by the Minnesota Student Branch of American Society of Agricultural Engineers at the University of Minnesota won first prize in competition with other student exhibits at the Annual Engineering Exposition held recently at the Minneapolis Armory. The exposition is sponsored by the Minnesota Federation of Engineering Societies which consists of sixteen member societies, including the Minnesota Section of ASAE.

In keeping with the Minnesota Centennial theme, the exhibit consisted of two model farms, one of 1849 vintage and the other a modern farm showing the progress in agriculture during the past 100 years. The modern farm illustrated numerous applications of the four branches of agricultural engineering. No detail was too small to be overlooked by the student ag engineers.

This exhibit of a model farm was constructed by the Minnesota Student Branch of ASAE and won first prize in competition with other student engineering exhibits at an exposition sponsored by the Minnesota Federation of Engineering Societies

NEWS SECTION *(Continued from page 247)*

On the modern farm considerable attention was attracted by a portable irrigation system which sprinkled one of the fields, and an electric fence which was energized at low capacity by an actual electric fence controller. The 1949 farm also had a well-planned farmstead with a complete set of modern farm buildings, modern farm machinery performing several field operations, a drainage system in operation, and fields terraced and strip-cropped to conserve soil and water.

The committee of students which planned and supervised construction of the exhibit included George Bowman, Harold Cloud, James Mattson, Donald Peters, Harvey Sandstrom, and Wallace Shelley. President of the ASAE Minnesota Branch is Jerome Larsen, and E. R. Allred is faculty adviser.

North Dakota Announces Change

ACCORDING to an announcement received from W. J. Promersberger, chairman, agricultural engineering department, North Dakota Agriculeural College, their curriculum which has heretofore provided for a '"major in agricultural engineering" will hereafter be known as the '"major in mechanized agriculture," which is in agreement with a resolution adopted unanimously at the annual meeting of the Association of Land-Grant Colleges and Universities at Washington last November. The curriculum content remains about the same, and the degree will be a BS in agriculture with a major in mechanized agriculture, and will be administered by the dean of agriculture.

Their five-year professional curriculum in agricultural engineering, however, remains in the school of engineering. The curriculum will be jointly administered by the deans of agriculture and engineering, in that the staff is in the school of agriculture, but the degree will be conferred by the dean of engineering. Both deans will be consulted when major problems in the department are involved.

At present the institution has 25 students enrolled in the professional curriculum and 52 in the major in mechanized agriculture.

Better Farm Wiring Encouraged by New Displays

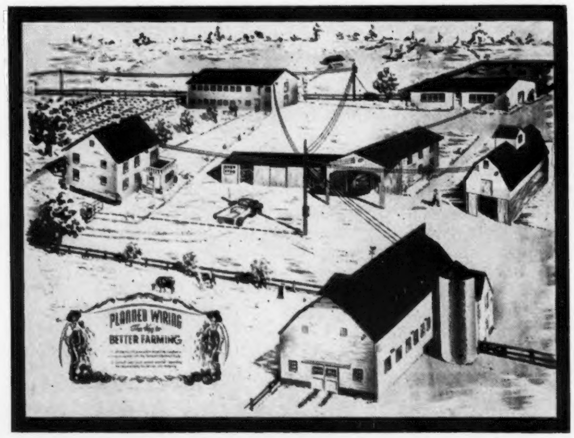
A GROUP of five new display posters illustrating recommended exterior and interior farm wiring practices was recently made available by the Farm Electrification Bureau of the National Electric Manufacturers Association.

Each poster is 30x40 inches in size and printed on 80-pound stock. A basic seven-color display piece shows a farmstead in perspective, with a load-center installation and wiring from a yard pole to various buildings. The other four posters feature two color isometric sketches and floor plans of the individual buildings of the farmstead, with wiring layout and electrical equipment installations.

The posters were developed by a Farm Wiring Coordinating Committee representing the National Adequate Wiring Bureau and the Farm and Rural Market Committee of the NEMA. Jos. S. Webb, agricultural engineer, Philadelphia Electric Co., headed the coordinating committee, which started work on the project more than a year ago.

Wiring Practices illustrated follow the recommendations published in the Handbooks of Farmstead and Residential Wiring Design.

Sets of the five displays are available at $2.00 postpaid, through the NEMA Farm Electrification Bureau, 155 East 44th St., New York 17, N. Y.



One of the NEMA better farm wiring posters

An Agricultural Engineer in Iran

TO THE EDITOR:

AT THIS writing, I am spending four months in Iran with Overseas Consulting, Inc., an organization of ten engineering firms recently incorporated. Men from all fields are here, including transportation, health, communications, economics, agriculture, industry, mining, water development, and perhaps others.

Agricultural engineers of all kinds are needed in this country. Eighty-five per cent of the people are in agriculture, and there is much more land available to farm, but without power the farmer cannot undertake it. In some areas water is going to waste while nearby it is a desert. Even where they irrigate, much water is wasted. There are rich oil deposits in the country, yet people are using desert vegetation for fuel, thus permitting sand to blow onto the good lands.

I have seen much of the country and feel that agricultural possibilities here are greater than in China. There is much more land to be farmed. Some needs water, while two million acres near the Russian border will raise 15-bushel wheat without additional water. This area is just beginning to be mechanized and can become very important.

The people here are very hospitable and treat us well. I hope we can help them solve their problems. Security is uppermost in all their minds. As one farmer said, "We want farm machinery, irrigating pumps, and security, so we can sleep nights."

Partner, Hansen Bros. E. L. HANSEN

ASAE Hawaii Section Authorized

AT A meeting on February 16 of the Honolulu Agricultural Engineers Club, members of the American Society of Agricultural Engineers located on the island of Oahu, together with other persons interested, considered petitioning the Society for authorization to organize a section on the Islands. A formal petition to the Council of ASAE was accordingly sent to Society headquarters, and the Council has now formally approved the organization of what will be known as the "Hawaii Section" of ASAE.

Georgia Section Meets

THE Georgia Section of the American Society of Agricultural Engineers held its spring meeting at St. Marks, Fla., April 15 and 16. Some forty members and guests attended. Officers elected for the coming year were as follows: P. W. Simons, chairman; J. I. Davis, Sr., vice-chairman, and W. D. Kenney, Secretary.

The customary program for this spring meeting is a deep-sea fishing expedition in the Gulf of Mexico. Success in this respect for this meeting was somewhat below set standard due to unsettled weather conditions.

Plans for the fall meeting were discussed which is to take place at a retreat in the North Georgia mountains and is to include the entire family.

EEI Farm Section Program

AN unofficial and unannounced theme, "Good business for farmers is good business for the industry," characterized the program for the farm section, April 5, in the fifteenth annual sales conference of Edison Electric Institute, in Chicago.

In addressing the farm section luncheon, Dr. William I. Myers, dean of agriculture, Cornell University, recommended that farmers "maintain full production but emphasize reduction of costs and increased efficiency and greater output per worker by improved work methods and lavor-saving equipment."

While indicating that 1949 might be a good year for American farmers by any normal standard, he recommended that they pay off debts and avoid overexpansion on credit. He pointed out factors both favorable and unfavorable to a gradual postwar readjustment from warboom inflation.

Dr. Harlan English, chairman of the committee on rural medical service, Illinois State Medical Society, pictured dramatically the opportunity for the electric industry to promote good business for farmers and the industry with equipment and applications favoring improved sanitation and lighting.

The good business theme was further developed by J. C. Cahill, chairman of the section; Fred Shaw, chairman, agricultural development committee; John L. Burgan, chairman, farm utilization committee; R. T. Jones, speaking on electric water system activities; A. G. Brown, deputy commissioner, agricultural commission, American Bankers Association; E. A. Hutchinson, vocational-agriculture teacher, Clintonville, Wis., and J. V. Baker, manager of farm electricfication, Sears, Roebuck and Co.

Applicants for Membership

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Anderson, Harold W.—Chief engineer, Turner Mfg. Co., Drawer No. 987 Statesville, N. C.

Barnett, Philip L.—Barnett Co., Bishop, Ga.

Bordelon, M. A.—Layout draftsman, engineering dept., J. I. Case Co. (Mail) 732 Charlotte Ave., Davenport, Iowa.

Carver, William O.—Draftsman and teacher of drafting, agricultural engineering dept., Michigan State College, East Lansing, Mich.

Fisch, Harrison C.—Instructor in agricultural engineering, Iowa State College, Ames, Iowa.

Howell, Ezra L.—Instructor in farm shop, North Carolina State College, Raleigh, N. C.

Ingram, Russell F.—Student, University of New Hampshire, Durham, N. H. (Mail) 6 Hetzel St.

Kearny, Frank J.—General manager, Davis Planting Co. (Mail) 2414 Octavia St., New Orleans, La.

Koski, Andrew, Jr.—Student, University of New Hampshire, Durham, N. H. (Mail) Box 556.

Lambie, J. W.—Agricultural engineer, Flaat Farms Co., Grand Forks, N. D.

Langdale, Harley, Jr.—Vice-president and general manager, Langdale, Co., Valdosta, Ga. (Mail) P. O. Box 980.

MacCarthy, James A.—Agricultural representative, rural electrification, British Columbia Electric Railway Co., Ltd., 570 Dunsmuir St., Vancouver, B. C., Canada.

Mauldin, Hurst—Associate agricultural engineer, Alabama Power Co., Birmingham, Ala.

Scholfield, Keith R.—Engineer, Deere & Co., Moline, Ill.

Severance, Charles E.—Assistant extension engineer (rural electrification), Louisiana State University, Baton Rouge, La.

Singer, Geo. C.—Advertising assistant, Public Service Company of Northern Illinois, Room 1448, 72 W. Adams St., Chicago, Ill.

Starr, James H.—Trainee, Cooperative G .L. F. Soil Building Service. (Mail) 26 Woodruff St., Waterbury 31, Conn.

Thompson, Comer B.—Sales engineer, Aluminum Company of America. (Mail) 505 First National Bldg., Birmingham, Ala.

Veitch, Samuel L.—Publisher, "The National County Agent and Vo-Ag Teacher," 1900 Chestnut St., Philadelphia 3, Pa.

Waters, George F.—Sales manager, Waters Conley Co., Rochester, Minn.

Weiss, Webster J.—Hay machinery engineering dept., J. I. Case Co., 700 State St., Racine, Wis.

Woodward, Guy O.—Irrigation extension specialist, University of Wyoming, Laramie, Wyo.

TRANSFER OF GRADE

Richard L. Patrick—Assistant professor of agricultural engineering, A. & M. College of Texas, College Station, Tex. (Junior Member to Member)

Taylor, B. C.—Rural service manager, Illinois Northern Utilities Co. (Mail) 421 W. First St., Dixon, Ill. (Junior Member to Member)

Thompson, J. L.—Agricultural engineer, Dominion Experimental Farm, Swift Current, Sask., Canada. (Junior Member to Member)

Turner, James R.—Agricultural engineer, Shell Chemical Corp. (Mail) 2425 Port Chicago Hwy., Concord, Calif. (Junior Member to Member)

New Literature

HEATING, VENTILATING, AND AIR CONDITIONING GUIDE, 1949 (27th edition). Illustrated and indexed. American Society of Heating and Ventilating Engineers (New York 10, N. Y.), $7.50.

Technical data section, manufacturers catalog data section, and brief information on the organization and activities of the ASHVE. The roll of membership of the Society which was included in previous editions has been omitted. The technical data section has eight subsection groupings as previously, and 52 chapters. Substantial changes and additions to 24 chapters are indicated. These include the chapters on terminology, fluid flow, heat transmission coefficients, air contaminants, instruments and measurements, physiological principles, air conditioning in the prevention and treatment of disease, heating load, cooling load, automatic fuel-burning equipment, heating boilers, mechanical warm air systems, steam heating systems and piping, unit heaters, electric heating, air cleaning devices, motors and motor controls, spray apparatus, refrigeration, air duct design, industrial exhaust systems, drying systems, transportation air conditioning, and codes and standards.

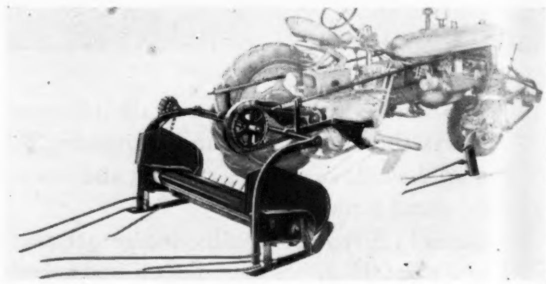
NEWS FROM ADVERTISERS

New Products and Literature Announced by AGRICULTURAL ENGINEERING Advertisers

The New Model 26 Massey-Harris Wide Level Disk Harrow is a wide -level disk harrow in the 30-disk size. The machine consists of 5 gangs of six 18-in disks fastened to the main axle in such a way as to allow each gang to float independently of the others, thus following the contour of the ground and cultivating at a uniform depth across the entire width of the harrow. Thirty 18-in, heat-treated disks throw the soil one way leaving a firm, even seedbed without ridges or furrows. Ideally suited to soil conservation practices, the new wide-level harrow mixes the soil and trash leaving enough stubble on top to help check wind erosion.

Massey-Harris wide-level disk harrow

Power-Operated Peanut Shakers (International Harvester) will be available for the Farmalls Super A, C, H, and M. The models will be known as A-33, C-34, and HM-32. All are power take-off operated. They mount on the rear of the tractor and are designed to work with the forward-mounted one and two-row peanut diggers. The new units will enable one man to dig, clean and windrow two rows of peanuts in one trip down the field. They save time and reduce harvesting costs, and vines are left for convenient handling or for uniform curing in the field.



Power-operated IH peanut shaker

Leveling and Grading Blade for the International Harvester Farmall "Cub" can be operated manually or by Farmall touch-control in light bulldozing, grading, leveling, and snow removal. Downward pressure exerted by the hydraulic touch-control system assists the blade in moving a greater quantity of material. The blade, which mounts either ahead of the tractor or between the front and rear wheels, measures 54x16x¼ in, with a cutting edge measuring 54x2¼x¼ in. The blade can be operated at various angles, pitches, and out-of parallel positions. The maximum rated load is 2,000 lb. The unit weighs 172 lb.

(*Continued on page 254*)

Leveling and grading blade for IH Cub

THIS *Magic Pint*

Lets your Fingers Lift almost ½ a Ton!

● **For centuries, "farming" has been synonymous with "hard work"... too much hard work. This handicapped the individual operator. It also shackled the progress of agriculture far more than most people realize.**

For hundreds of thousands of farmers this Magic Pint has eliminated plenty of hard work and thereby promoted the progress of agriculture! For this Magic Pint of oil is the power transfer agent . . . the medium that converts engine power in the Ford Tractor to hydraulic power the farmer uses to save his back and arms, his strength and energy, his time and money. It's this Magic Pint that lets his fingers lift almost one-half a ton!

Hydraulic control of implements is an integral part of Ford Tractor design. As a matter of fact, the hydraulic pump, valves, cylinder and piston are built *inside* every Ford Tractor.

Furthermore, Dearborn Implements for the Ford Tractor can take full advantage of hydraulic power. It is one reason why Dearborn Implements are characterized by unusual and superior design, far simpler construction and vastly improved performance.

This is a fascinating story; one any person with a strong interest in agriculture will want to know more about. To receive additional information, write to us direct, or ask your nearest Ford Tractor dealer to demonstrate the many interesting features of the Ford Tractor and the Dearborn Farm Equipment engineered for it.

Dearborn FARM EQUIPMENT

DEARBORN MOTORS CORPORATION • DETROIT 3, MICHIGAN

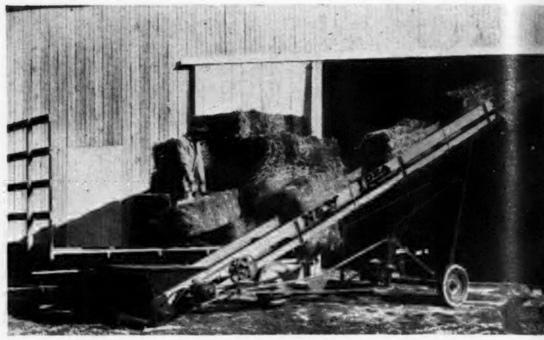
Ford Farming

**MEANS LESS WORK . . .
MORE INCOME PER ACRE**

News from Advertisers

(Continued from page 252)

The new "New Idea" portable elevator is an all-purpose elevator which will handle bales, bags, crates, ear corn, small grain, or almost anything the farmer wants to move, according to announcement by New Idea, Division of Avco Mfg. Corp., Coldwater, Ohio. This No. 90 elevator features a trough 17½ in wide which will handle loads without adjusting the sides. The truck, which has a 66-in spread and is strongly braced and trussed to assure a safe foundation, can be adjusted for elevators from 26 to 36 ft so that weight is balanced. This permits safe and easy moving without disconnecting the trunk sections. Power can be introduced at either end of the shaft in the boot section or the head section. Adjustable, reversible motor bracket is available for electric motor or small engine. Power take-off drive attachment permits use of tractor on either side of trunk.



The new 'New Idea'' portable farm elevator

Field Hay Chopper (International Harvester) for use in harvesting grass or forage crops for ensiling and for field chopping dry hay to be blown in mows. This new hay chopper, which will be in limited production in 1949, is essentially a combination of Harvester's No. 9 ensilage cutter rotor complete with knives, housing and transmission, and the pickup and feeding mechanism of the No. 50-T pickup baler. The crop is picked up from the windrow and is automatically fed to the rotor which chops it into lengths ranging from ½ to 4 in as desired. The air blast from the rotor delivers the chopped material into a trailing wagon or a truck moving alongside the chopper in the field. The chopper is power-take-off driven by any two-plow or larger size tractor equipped with standard power take-off. Width of pickup cylinder is 54 in, width of throat 16 in, and diameter of blower is 49 in. The rotor has four knives. The wheels are rubber tired with 7:50x16, 6-ply left hand, and 5:50x16 4-ply right hand.

International Harvester field hay chopper

Personnel Service Bulletin

The American Society of Agricultural Engineers conducts a Personnel Service at its headquarters office in St. Joseph, Michigan, as a clearing house (not a placement bureau) for putting agricultural engineers seeking employment or change of employment in touch with possible employers of their services, and vice versa. The service is rendered without charge, and information on how to use it will be furnished by the Society. The Society does not investigate or guarantee the representations made by parties listed. This bulletin contains the active listing of "Positions Open" and "Positions Wanted" on file at the Society's office, and information on each in the form of separate mimeographed sheets, may be had on request. "Agricultural Engineer" as used in these listings is not intended to imply any specific level of proficiency, or registration, or license as a professional engineer.

NOTE: In this Bulletin the following listings still current and previously reported are not repeated in detail. For further information see the issue of AGRICULTURAL ENGINEERING indicated.

POSITIONS OPEN: 1948. JULY—O-627, 630. SEPTEMBER—O-641. 1949. MARCH—O-661, 662, 663.

POSITIONS WANTED: 1948. AUGUST—W-184. NOVEMBER—W. 196, 203. DECEMBER—W-209. 1949. JANUARY—W-211, 212, 215, 216. FEBRUARY—W-218, 219, 220, 222, 223, 225. MARCH—W-227, 228, 230, 232, 233, 234, 235, 236. APRIL—W-237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248.

NEW POSITIONS OPEN

AGRICULTURAL ENGINEER (associate or assistant rank) (2 openings) for research in grain and grass seed harvesting, drying, storage, etc. in a state agricultural experiment station in the South. One opening at main station and one at a new branch station. BS or MS deg in agricultural engineering or equivalent, MS preferred. Uusual personal qualifications for public service research. Age 25-35. Salary $3200 to 4200, plus housing. O-666

AGRICULTURAL ENGINEER (assistant professor or instructor) for teaching farm machinery, farm structures, farm shop, utilities, and elementary surveying, in a state college in the Southwest. MS deg in agricultural engineering, or equivalent. Teaching or practical experience in indicated fields desirable. Good health and pleasing personality required. Opportunity for advancement normal. New department. Age, under 40. Salary $3000-3600. O-667

RESEARCH FELLOW in agricultural engineering, for half-time research on engineering applications in grassland agriculture; half-time study for MS deg, which candidate should receive in 2 years. Location, East. BS deg in agricultural or mechanical engineering. Farm background. Good student, with neat and orderly work habits, and good health. Annual basis, with one month vacation. Position open June 1. Majority of graduate study can be in College of Engineering. Cottage available in agricultural engineering area for two single graduate students or one married couple without children. Salary $1200 (plus full subsistence allowance to eligible veterans.) O-668

RESEARCH FELLOW in agricultural engineering for half-time research in engineering applications of rotary tillage; half-time study for MS deg, which candidate should receive in one year. Location, East. BS deg in agricultural or mechanical engineering. Farm background. Good student, with neat and orderly work habits, and good health. Employment for 12 mo, no vacation. Position open June 1. Majority of graduate study can be in College of Engineering. Cottage available in agricultural engineering area for two single graduate students or one married couple without children. Salary $1200 (plus full subsistence allowance to elegible veterans.) 0-669

FACTORY SUPERINTENDENT to take charge of production, including improvement of factory layout and methods, and possibly some development work, for established farm equipment manufacturer in the East. Engineering degree and production and development experience with farm equipment manufacturer required. Must be able to assume complete responsibility and have initiative to carry out assignments. This is a small but profitable company. Excellent future opportunity which will broaden as company prospers. Age 35-45. Salary $6000-8500. 0-670

NEW POSITIONS WANTED

AGRICULTURAL ENGINEER desires development, research, sales, or service work in power and machinery or soil and water field, with experiment station, manufacturer, processor, or trade association, anywhere in U S A or elsewhere. BS deg in agricultural engineering expected June 1, Kansas State College. Farm background. Has maintained and operated most types of farm machinery common to Midwest. Aircraft mechanic and inspector sub-supervisor 2 years in factory. Aircraft inspector one year, U S Army. Telephone installation and repair, and training Chinese Army Signalmen, 21 mo, U S Army. Student assistant in agricultural engineering research on heat pump. No disability. Available June 15. Married. Age 27. Salary open. W-249

AGRICULTURAL ENGINEER desires design, development, extension, research, service, teaching, or testing in power and machinery field, in public service or private industry preferably in U S A, but would consider desirable foreign location. BS deg in agricultural engineering expected in June, University of Tennessee. Sheet metal worker one year. Enlisted and noncommissioned war service in Army Air Corps, 3 years. No disability. Available July 25. Married. Age 27. Salary open. W-250

AGRICULTURAL ENGINEER desires design, development or research work in power and machinery field, with manufacturer in U S A, preferably in Midwest. BS deg in agriculture June 1948; BS deg in mechanical engineering expected June 1949, both at University of Wisconsin. One summer as apprentice carpenter and one summer in production work with Perlick Brass Co. War service in U S Merchant Marine. No disability. Available June 25. Single. Salary $275-300 mo. W-252

(Continued on page 258)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PERSONNEL SERVICE BULLETIN

(Continued from page 256)

AGRICULTURAL ENGINEER desires design, development, extension, research or teaching in power and machinery field, with experiment station, manufacturer, processor, or farming operation, preferably within U S A. BS deg in agricultural engineering expected in June, Iowa State College. Farm background. Familiar with operation of farm machinery. Laboratory assistant in engineering experiment station, 3 mo. War service 33 mo, U S Marine Corps. No disability. Available June 20. Married. Age 25. Salary $275 mo. W-253

AGRICULTURAL ENGINEER desires design, development, research, or teaching, in soil and water field, with college, experiment station, federal department, manufacturer, or distributor anywhere in U S A. BS deg in agricultural engineering June 1948, MS deg expected July 1949, University of Minnesota. Research and teaching assistant, one year. Ship rigger, 6 mo. War service in Army Air Force 4 years, commissioned. No disability. Available July 15. Married. Age 27. Salary $3600. W-254.

AGRICULTURAL ENGINEER desires design, development, or sales work in power and machinery field, with manufacturer or distributor in U S A or Canada. BS deg in engineering with major in agricultural engineering May 1949, University of British Columbia. Summer employment 5 mo as junior structural draftsman with public utility, and 5 mo as farm equipment salesman. War service in RCAF 4½ years. Served as flight commander in fighter squadron. Amputation left arm, disability negligible for engineering work. Available June 1. Single. Age 27. Salary open. W-255

AGRICULTURAL ENGINEER desires work as farm manager, preferably in southern state. BS deg in agricultural engineering 1942, University of Tennessee. Farm background. More than 3 years on dairy farm. Familiar with farm machinery, care and handling of milk cows, pasteurization and bottling of grade-A milk, and delivery of bottled milk on retail and wholesale routes. Time study work 3½ years with Aluminum Company of America. Deaf in left ear. Available within 30 days. Married. Age 31. Salary open. W-256

AGRICULTURAL ENGINEER desires development, management, research, or service work in soil and water or farm product processing field with private industry, anywhere in U S A. BS deg in agriculture 1948; BS deg in civil engineering expected June 1949, University of Wisconsin. Farm background. P-1 engineer on drainage work 3 mo summer 1948. War service nearly 2 years, U S Navy. No disability. Available July 1. Age 23. Salary open. W-257

AGRICULTURAL ENGINEER desires service, research, or project engineering work in the soil and water or farm structures field, in private industry or public service. BS deg in agricultural engineering expected in June, University of Vermont. Farm background. Conservation Aide, Soil Conservation Service, summer of 1948. War service in U S Navy 3 years. No disability. Available July 15. Married. Age 26. Salary open. W-258

AGRICULTURAL ENGINEER desires sales or service or technical writing in power and machinery or rural electrification field. BS deg in agricultural engineering expected in June, Pennsylvania State College. Dairy and poultry farm experience. General clerical work 1½ years with bank and trust company. War service more than 4 years in U S Army, including army specialized training program, administrative and personnel work, training, and combat. No disability. Available June 6. Single. Age 25. Salary open. W-259

AGRICULTURAL ENGINEER desires design, development, or testing work in power and machinery field, with manufacturer or distributor, preferably in Midwest. BS deg in agricultural engineering expected in June, University of Missouri. War service over 3 years in naval aviation. No disability. Available June 15. Married. Age 24. Salary $250 mo (or less in job offering exceptional opportunity). W-260

AGRICULTURAL ENGINEER desires design, development, service, or extension work in power and machinery, rural electric, or soil and water field, in public service or private industry, preferably in the Southwest or West. BS deg in agricultural engineering expected in June, New Mexico A and M College. Farm background. Surveying 3 mo with army engineer party, Roswell (N.M.) Air Base. Carpenter apprentice 6 mo. War service 3 years, in aerial navigation. No disability. Available in June. Married. Age 25. Salary open. W-261

AGRICULTURAL ENGINEER desires development, research, sales, or service work in power and machinery, soil and water, or farm structures field, with private employer or public service. Will consider outside continental U S A. BS deg in agricultural engineering expected in June, New Mexico A and M College. Student assistant in agricultural engineering department one year. Member of theodolite surveying party, ballistics research laboratory, White Sands Proving Ground (N. M.) one year. War service in Army Air Corps as aviation mechanic, gunner, and electrical specialist, over 3 years. No disability. Available June 5. Single. Age 25. Salary open. W-262

AGRICULTURAL ENGINEER desires design, development, research, service, or extension work in power and machinery or farm structures field. May be interested in graduate fellowship or assistantship. BS deg in agricultural engineering expected in June, New Mexico A and M College. Farm background. War service over 2 years in army aircraft maintenance. No disability. Available in September. Single. Age 23. Salary open. W-263

AGRICULTURAL ENGINEER desires sales, service, or project engineering work in power and machinery or irrigation; farm supervision; or farm structures installation, in private industry or public service, preferably in West or Midwest. BS deg in agricultural engineering expected in August, New Mexico A and M College. Farm background. Mechanical and surveying experience in Army. Various sales experience in part-time work. War service in Army Air Corps over one year. No disability. Available September 1. Married. Age 23. Salary open. W-264

AGRICULTURAL ENGINEER desires college teaching and research work in soil and water field. BS deg in agricultural engineering, 1947; MS deg March 1949, with major in soil and water conservation, Iowa State College. Two years teaching one-half to full time, both professional and nonprofessional courses in farm mechanics and in soil and water conservation engineering. War service in Army Signal Corps, over 4½ years, with promotion to Captain. No disability. Available July 1. Married. Age 29. Salary open. W-265 *(Continued on page 260)*

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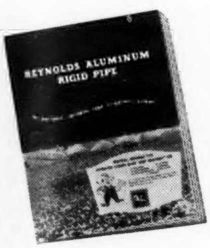

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PROFESSIONAL DIRECTORY

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PERSONNEL SERVICE BULLETIN

(Continued from page 258)

AGRICULTURAL ENGINEER desires teaching, research, or product training in power and machinery field, in public service or industry, anywhere in the United States. BS deg in agricultural engineering December 1947; MS deg December 1948, Iowa State College. Research fellow, agricultural engineering section, Iowa Agricultural Experiment Station, one year. Teaching, agricultural engineering department, Iowa State College, January 1949 to present. War service in Army Air Force with promotion to First Lieutenant (fighter pilot). No disability. Available July 1. Single. Age 27. Salary open. W-266

AGRICULTURAL ENGINEER desires development, extension, or management in farm structures or soil and water field, with public service or private industry. Midwest location preferred. BS deg in agricultural engineering expected in June, Iowa State College. Surveying experience with Soil Conservation Service, 3 mo. No disability. Available July 1. Single. Age 21. Salary open. W-267

AGRICULTURAL ENGINEER desires development, extension, research, or teaching work in rural electric field, in public service or private industry, with location either in U S A or foreign country. Particularly interested in farm refrigeration. BS deg in agricultural engineering 1949, Michigan State College. MS deg in agricultural engineering expected in fall, 1949, University of Minnesota. California dairy farm background. Demonstrated moisture testing of hay one month. War service over 4 years, U S Army. No disability. Available December 1949. Married. Age 33. Salary $3700. W-268

AGRICULTURAL ENGINEER desires design, development, or research work in power and machinery or rural electric field, with manufacturer, in U S A. BS deg in agricultural engineering expected in June, Michigan State College. War service in Army Air Force almost 2 years. No disability. Available June 8. Married. Age 23. Salary open. W-269

AGRICULTURAL ENGINEER desires design, development, research, or service work in power and machinery field with college or manufacturer. BS deg in agricultural engineering 1941, Texas A and M College. Additional study as reserve midshipman, U S Naval Academy; and in diesel engineering at Pennsylvania State College. P-1 engineer with Soil Conservation Service 3 years. P-2 engineer and conservationists with Soil Conservation Service one year, 9 months. Field engineer on design research, development and service work with clutch manufacturer since September 1948. War service in U S Navy 4 years, with promotion to Lt(jg)(E). No disability. Available within 30 days. Married. Salary $4500. W-270

AGRICULTURAL ENGINEER desires design, development, extension, management, research, sales, or teaching in power and machinery, farm structures, or soil and water field, including irrigation and drainage, drafting, and surveying, in public service or private industry, preferably in central or southern Florida for relief of asthma of wife and child. BS deg in agricultural engineering expected February 1950, University of Missouri. Pipe fabrication, layout, and sales one year. Lathe and milling machine operator in aircraft manufacture, 2 years. War service 5 years, with promotion to First Lieutenant (pilot) U S Marine Corps. No disability. Available June through September, 1949, and February 1, 1950. Married. Age 26. Salary open. W-271

AGRICULTURAL ENGINEER desires design, research, or management work in power and machinery or product processing field, in public service or private industry, in U S A or Canada. BS deg, McGill University, 1948. MS deg expected August 1949, Cornell University. Dairy and tobacco farm background. Machine shop experience, 5 mo. Experimental farm 11 mo, on research in pest control equipment development. War service 6 years, Royal Canadian Navy, with promotion to Lieutenant Commander. No disability. Available September 1. Married. Age 29. Salary $4000. W-272

AGRICULTURAL ENGINEER desires extension, management, sales, or service work in power and machinery, soil and water, or farm management field, with manufacturer, processor, or distributor, or in farming operation. BS deg in agricultural engineering expected in June, University of New Hampshire. Farm background. War service nearly 2 years, Army Air Force. No disability. Available June 20. Single. Salary open. W-273